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# General-Purpose Office Chairs – Tests

## American National Standard for Office Furnishings

## American National Standard

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Published by

BIFMA
BUSINESS + INSTITUTIONAL FURNITURE MANUFACTURERS ASSOCIATION



***Printed in the United States of America***

# American National Standard

# for Office Furnishings

# General-Purpose Office Chairs - Tests

**Sponsor**
**BIFMA**
**678 Front Ave. NW, Suite 150**
**Grand Rapids, MI 49504**
**(616) 285-3963**
**email@bifma.org**
**www.bifma.org**

**Approved February 2, 2017**

**American National Standards Institute**

**Foreword**

The material presented in this standard was developed as a result of the efforts of the members of BIFMA 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 safety, durability, and structural adequacy of general-purpose office chairs.

The original work on this standard was completed in May 1974 by the BIFMA Engineering Committee and, particularly by its Subcommittee on Chair Standards. During the periods from February 1983 through January 1984, March 1990 through April 1993, September 1997 to October 2002, September 2007 to April 2009, and again from April 2014 to May 2015 the Subcommittee on Chair Standards conducted reviews of the standard to ensure that the tests accurately describe the proper means of evaluating the safety, durability, and structural adequacy of general-purpose office chairs. The reviews produced revisions and/or additions to the various test procedures that improve the procedures and provide consistency. The revisions were submitted to the membership of BIFMA for approval in May 2015. The canvass of interested parties and stakeholders was conducted in accordance with the requirements of an ANSI accredited standards developer. 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 February 2, 2017.

Suggestions for the improvement of this standard are welcome. The suggestions should be sent to BIFMA, 678 Front Ave. NW, Suite 150, Grand Rapids, MI 49504-5368.

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American National Standard
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# General-Purpose Office Chairs - Tests

## 1 Scope

This standard is intended to provide manufacturers, specifiers, and users with a common basis for evaluating the safety, durability, and structural adequacy of general-purpose office chairs. General-purpose office chairs are normally used in an office environment and may include, but are not limited to those seating styles typically referred to as: executive/management, task/secretarial, side/guest chairs, nesting folding chairs, tablet arm chairs and stools.

This standard describes the means of evaluating general-purpose office chairs, independent of construction materials, manufacturing processes, mechanical designs or aesthetic designs. This standard does not address lounge seating, flammability, surface material durability, cushioning materials, product emissions, or ergonomic considerations.

The standard defines specific tests, the laboratory equipment that may be used, the conditions of tests, and the minimum acceptance levels to be used in evaluating general-purpose office chairs. The acceptance levels and test parameters given in this standard are based on the actual field use and test experience of BIFMA members. Where appropriate, the National Health and Nutrition Examination Survey (NHANES) 2007-2010 study, which indicates the weight of the 95th percentile male is 125 kg (275 pounds), was used in the development of the tests. This does not mean that users with weights above the percentiles referenced cannot safely or comfortably use a chair developed to a given BIFMA standard. (See also Appendix E). The tests were developed with an estimated product life of ten years based on single-shift usage. Product life will be affected by user size/weight, product use, care and maintenance, environment, and other factors, and, as such, product compliance to this standard does not necessarily guarantee a ten-year product life.

The tests in this standard are intended to assess the performance of new products only. They are not intended to assess a product that has been in use.

ISO 17025 requirements for measurement uncertainty do not apply to this standard.

**Note:** Large Occupant office chairs are covered by ANSI/BIFMA X5.11; Lounge and Public Seating products are covered by ANSI/BIFMA X5.4; and Educational Seating products are covered by ANSI/BIFMA X6.1. Please check for the latest revision.

## 2 Definitions

**Note:** Refer to BIFMA PD-1 Mechanical Test 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 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 appropriate rate:** Any rate that avoids resonant frequencies or excessive heating.

**2.3 back stop position:** The position of the unit when the unit's tilt mechanism first contacts its rearward mechanical stop, regardless of the force on the backrest.

**2.4 CMD:** The Chair Measuring Device used for the measurement of seating products.

**2.5 CMD-1 Chair Measurement Procedure:** A universal procedure for the BIFMA Chair Measuring Device. (ISO/TR 24496 Procedure may be used for the ISO CMD).

**2.6 counterbalancing force:** A force or influence that offsets an opposing force.

**2.7 cycle:** A complete operation of loading and unloading or of stress reversal; to open and close; one complete revolution; to operate in a cyclic manner.

**2.8 folding chair:** a unit in which the seat pan, legs, and/or other components may be modified for purposes of efficient storage.

**2.8.1 arena folding chair:** a seating unit in which the seat folds independent of the legs, yet the legs will fold also. (**Note:** arena folding chairs are not covered in the ANSI/BIFMA X5.1 standard).

**2.8.2 nesting folding chair:** a seating unit in which the seat pan flips up allowing products to nest together. The legs do not fold for this type of chair.

**2.8.3 standard folding chair:** a seating unit in which the seat and legs fold together into a flat product for efficient storage. (**Note:** standard folding chairs are not covered in the ANSI/BIFMA X5.1 standard).

**2.9 force:** A vector quantity, expressed in newton (N) or pounds force (lbf.) that tends to produce an acceleration of a body in the direction of its application.

**2.10 form-fitting device:** A device that distributes a force over a 305 ± 13 mm x 70 ± 32 mm (12 ± 0.5 in. x 2.75 ± 1.25 in.) area of a backrest. The device will be shaped to approximate the contours of the chair backrest.

**2.11 front stop position:** The position of the unit when the unit's tilt mechanism first contacts its forward mechanical stop.

**2.12 functional load:** The level of loading or force considered typical of hard use.

**2.13 general-purpose office chairs:** Chairs normally used in an office environment. These may include, but are not limited to those seating styles typically referred to as:

executive/management, task/secretarial, side/guest chairs, stacking chairs, tablet arm chairs and stools.

**2.14 general-purpose large occupant office chairs:** Chairs normally used in an office environment for larger persons. To qualify as such the chair shall have a minimum seat pan width of 560 mm (22 inches). These may include, but are not limited to those seating styles typically referred to as: executive/management, task/secretarial, side/guest chairs, stacking chairs, and tablet arm chairs.

**2.15 IFD:** Indentation Force Deflection. See Test $B_1$, Indentation Force Deflection Test, in ASTM D 3574 Standard Methods for Flexible Cellular Materials - Slab, Bonded, and Molded Urethane Foams.

**2.16 lbf.:** Abbreviation for pounds-force. The corresponding unit in the SI (Systeme International) system is the newton (N).

**2.17 leg-base:** a chair support structure consisting of three or more supports (legs) that are greater than 152 mm (6 in.) in height before attaching to a centralized support. Each structure of the base rests on the floor individually; typically through a glide, foot, or caster. (See also pedestal base and see Appendix J).

**2.18 load:** The weight to which a structure is subjected; a weight or force applied to a product; force acting on a surface, usually caused by the action of gravity.

**2.19 load-bearing structure/surface:** Any element that supports loads during use. Foam and fabric, for example, are not generally considered load-bearing surfaces, nor are some portions of waterfall edges.

**2.20 loss of serviceability:** The failure of the product to support its intended load or to perform all of its normal functions or adjustments.

**2.21 lounge seating:** Seating that is intended for use in indoor public spaces such as waiting, reception, or lounge areas. Lounge seating includes products with single seat units or units with multiple seating positions within one unit. Lounge seating may be fixed to the building structure or freestanding. It is generally not adjustable for personal use.

**2.22 manufacturer's instructions:** Instructions for assembly, operation, and/or maintenance supplied by the manufacturer to the customer.

**2.23 N (newton):** a unit of force in the SI (Systeme International) System, also known as the Metric System.

**2.24 normal use condition:** For consistency, the midpoint of any adjustment range, such as the height adjustment or counter balancing force adjustment unless otherwise specified in the test method.

**2.25 pedestal base:** A base that supports a chair by a single central structural member such as a column with individual (near horizontally positioned) legs. (See also leg-base).

**2.26 pivoting backrest:** A backrest that rotates on a horizontal axis above the height of the seat.

**2.27 proof load:** The level of loading or force in excess of hard use.

**2.28 stool:** A chair with a seat height greater than 610 mm (24 in.), intended to allow the user to sit at standing-height work surfaces such that the user's feet are not supported by the floor.

**2.29 tablet arm:** A surface attached to a chair that has the primary function to support tasks such as writing and short-term reference material handling. These surfaces typically do not have independent support legs and are not intended to support a person's weight. The tablet arm/writing surface derives its support from the chair; the chair does not derive structural support from the writing surface. These surfaces may be fixed or have tilt and/or stowaway capability.

**2.30 test surface/platform:** The horizontal hard surface, (concrete or other non-deforming surface) on which the chair to be tested is placed during testing.

**2.31 worst-case condition:** The product and/or condition (i.e. size and construction of a given unit type) most likely to be adversely affected by an individual test or testing sequence.

# 3 General

## 3.1 Testing Considerations

**3.1.1** The testing and evaluation of a product according to 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 the use of those materials and/or equipment. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish health/safety practices and any applicable regulatory requirements prior to the use of the materials or equipment described.

**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 and/or life cycle testing.

**3.1.3** The tests described in this standard are intended to evaluate the entire chair assembly, including the base, tilt mechanism, height adjustment device, locking/adjustment mechanisms, seat/backrest attachment, etc.

**3.1.4** Each manufacturer's model or unit type in any configuration (allowed by the manufacturer's planning guide) shall comply with applicable requirements when tested in accordance with this standard. Only worst-case product, condition, and/or furniture configurations (including height adjustment capability) need to be tested. A worst-case product/condition/configuration 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. Instruction documents and other literature provided by the manufacturer will be helpful in determining which products and/or product configurations that are implicitly or explicitly recommended by the manufacturer when determining compliance; it is expected that any and all configurations recommended by the manufacturer will be able to meet the acceptance levels of the tests in this standard. **Note:** Multiple product types/styles may need to be tested to evaluate worst-case conditions.

**3.1.5** The test methods included in this standard require the use of fixtures and/or load adapters to perform the tests. Some products and/or constructions may need special test fixtures, load adapters, etc., to perform these tests in a manner that meets the intent of the standard. This is especially true of products with complex articulation of joints, unique motions or adjustments, or non-traditional use of materials. The users of this standard are encouraged to develop appropriate fixtures and/or test variations that more accurately simulate application of loads, etc., for given unique products in a manner that reflects actual use. Fixtures, load

adapters, etc., shall not add structure or provide support to the product being tested. If a test procedure cannot be performed as specified in the procedures due to the design of the product, it shall be carried out as far as possible as described, and deviations from the procedure shall be recorded in the test report (See Section 3.9). Independent/consumer testing facilities may need to consult with product manufacturers to ensure any special conditions are considered during testing.

**3.1.6** It is not intended that all of the tests in this standard be conducted on a single unit. The tests may be performed on a series of units at the discretion of the manufacturer. When a test requires a functional load and a proof load be applied as part of the test criteria, the functional and proof loads shall be applied to the same component or unit. The tests may be performed in any sequence unless otherwise specified within a given test section; the functional load shall always precede the proof load.

**3.1.7** Table 1 indicates the tests that when applicable shall be performed on each type of chair, as defined in Section 4.

**3.1.8** Two types of load levels are generally used:

a) Functional loads are generally used to evaluate the durability/longevity of the products under hard use and typically define acceptable performance in terms of continuing serviceability.

b) Proof loads are generally used to evaluate the performance of the product in excess of hard use and typically define acceptable performance in terms of structural integrity.

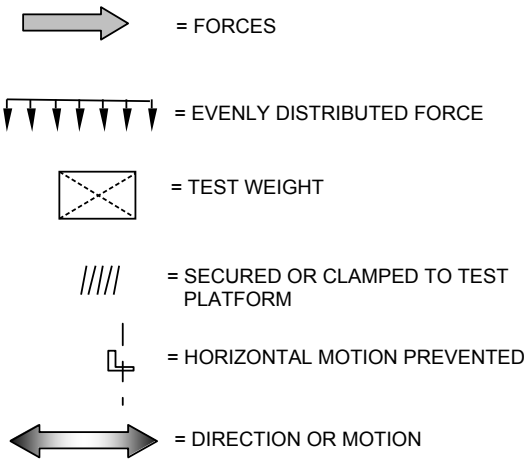
### 3.2 Manufacturer's Instructions

Where supplied, manufacturer's assembly instructions shall be followed during the initial assembly or setup of the chair. When a manufacturer recommends specific instructions or maintenance adjustments that may be required in order to keep the product in good operating condition, unless otherwise specified by these test procedures, the manufacturer's assembly, operating and maintenance instructions shall be followed.

### 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 Measurements

The BIFMA Chair Measurement Device (CMD) or the ISO CMD is to be used in determining applicable setup measurements. The setup measurement may be determined for an individual model and used for all tests for that model. In order for measurements to be "universally" acceptable, only Chair Measuring Devices (CMD) built to BIFMA or ISO specifications may be used. Requests for more information regarding the BIFMA or the ISO CMD should be directed to BIFMA.

### 3.6 Tolerances

Unless otherwise specified, tolerances shall be:

- Test Weights, Forces, Velocities, and Time, ± 5%
- Linear measurements, ± 1.5 mm (1/16 in.)
- Angles, ± 5 degrees
- Level, within 5 mm per meter (0.06 in. per linear foot) or ± 0.3 degrees
- Cycle requirements are minimums.

Test weights, forces, dimensions, angles, times, rates and velocities used to perform the test shall be targeted at the nominal values specified and shall be subject to the above tolerances. Devices used to calibrate test devices and/or machines shall be calibrated to one-fourth of the above tolerance, with the exception of Level, which shall be calibrated to one-half.

### 3.7 Test Force Application

To ensure that negligible dynamic force is applied, the forces in the static force tests shall be applied sufficiently slowly until the target load/force is achieved. Where time limits are given, loads and forces shall be maintained according to the tolerance given in Section 3.6 unless otherwise specified.

### 3.8 Pretest Inspection

Before beginning the testing, visually inspect the unit thoroughly. Record any defects so that they are not assumed to have been caused by the tests.

### 3.9 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 insure 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.

### 3.10 Temperature and Humidity Considerations

Products should be conditioned to ambient laboratory conditions for temperature and relative humidity prior to testing.

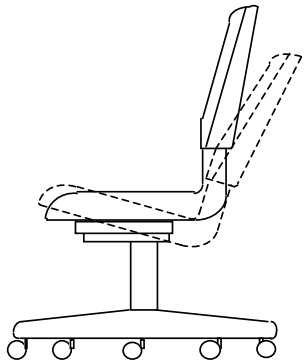


**Figure 4a - Type I - Tilting Chair**

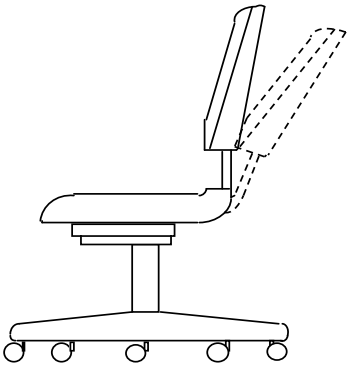


**Figure 4b - Type II - Fixed seat angle, tilting backrest**

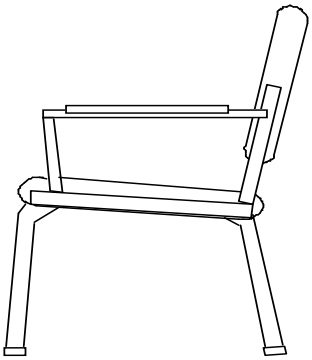


**Figure 4c - Type III - Fixed seat angle, fixed backrest**

**Types of Chairs**

## 4 Types of Chairs

To accommodate a wide variation in chair designs, it may be necessary to apply the tests to various types of chairs.

If a product can be classified as more than one chair type, it shall be tested under all applicable classifications. For example, a chair with a locking tilt mechanism would be classified as both a Type I (when the mechanism is unlocked) and Type lll chair (when the mechanism is locked). Chair types are used to determine specific tests parameters and test applicability. Chairs that do not fit into one of these three types will exist (eg., backless stools) and may still be tested to the applicable tests/requirements within this standard.

The following classification of types and features of chairs provides standard product identification:

**4.1 Chair Type:** **Type I. Tilting chair:**

A chair with a seat and backrest that tilt (either in unison or in synchronization) with a counterbalancing force. Chairs of this type are typically referred to as synchro-tilt, center-tilt, knee-tilt, etc.
(See Figure 4a)

**Type II. Fixed seat angle, tilting backrest:**

A chair that provides a fixed seat angle with a tilting backrest.
(See Figure 4b)

**Type III. Fixed seat angle, fixed backrest:**

A chair that provides a fixed seat angle with a fixed backrest.
This may include chairs with legs, including sled base chairs.
(See Figure 4c)

**TABLE 1 – Test Guide by Chair Type**

| Section Number | Description | Type I | Type II | Type III |
|---|---|---|---|---|
| 5 | Backrest Strength Test - Static - Type I and II | X | X | |
| 6 | Backrest Strength Test - Static - Type III | | | X |
| 7 | Drop Test - Dynamic | X | X | X |
| 8 | Swivel Test - Cyclic | X | X | X |
| 9 | Tilt Mechanism Test - Cyclic | X | X | |
| 10 | Seating Durability Test - Cyclic | X | X | X |
| 11 | Stability Tests | X | X | X |
| 12 | Arm Strength Test - Vertical - Static | X | X | X |
| 13 | Arm Strength Test - Horizontal - Static | X | X | X |
| 14 | Backrest Durability Test - Cyclic - Type I | X | | |
| 15 | Backrest Durability Test - Cyclic - Type II and Type III | | X | X |
| 16 | Caster/Chair Base Durability Test - Cyclic | X | X | X |
| 17 | Leg Strength Test - Front and Side Application | X | X | X |
| 18 | Footrest Static Load Test - Vertical | X | X | X |
| 19 | Footrest Durability Test - Vertical - Cyclic | X | X | X |
| 20 | Arm Durability Test - Cyclic | X | X | X |
| 21 | Out Stop Test for Chairs with Manually Adjustable Seat Depth | X | X | X |
| 22 | Tablet Arm Chair Static Load Test | X | X | X |
| 23 | Tablet Arm Chair Load Ease Test - Cyclic | X | X | X |
| 24 | Structural Durability Test - Cyclic | X | X | X |

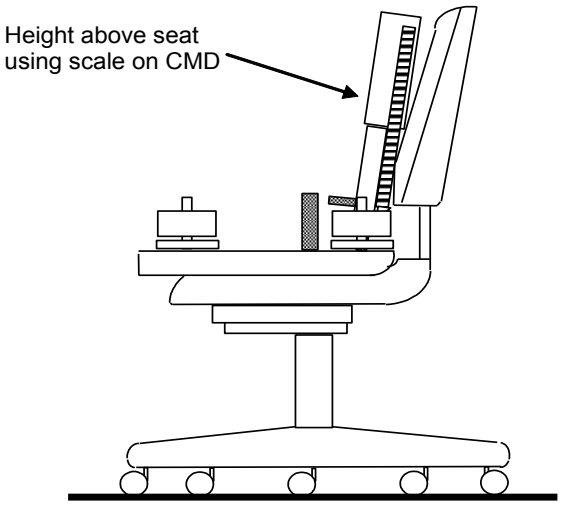



**Figure 5a - Height Determination**
**Backrest Strength Test - Static - Type I and II**

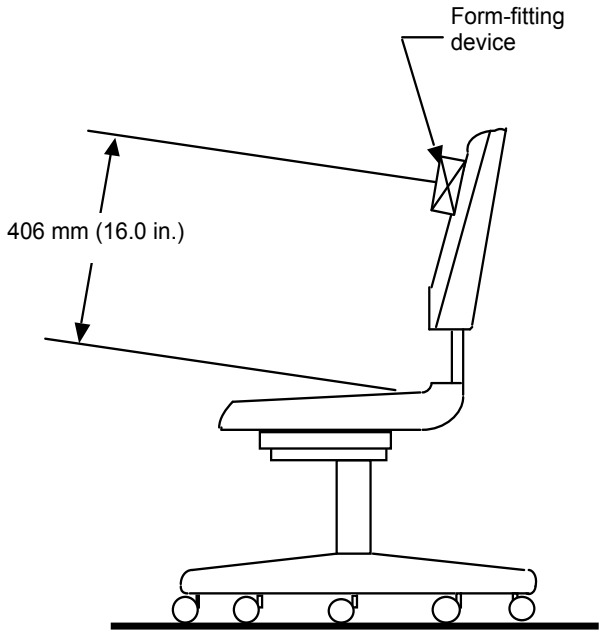



**Figure 5b - Positioning of Form-Fitting Device for Backrests Higher than 452 mm (17.8 in.) Backrest Strength Test - Static - Type I and II**

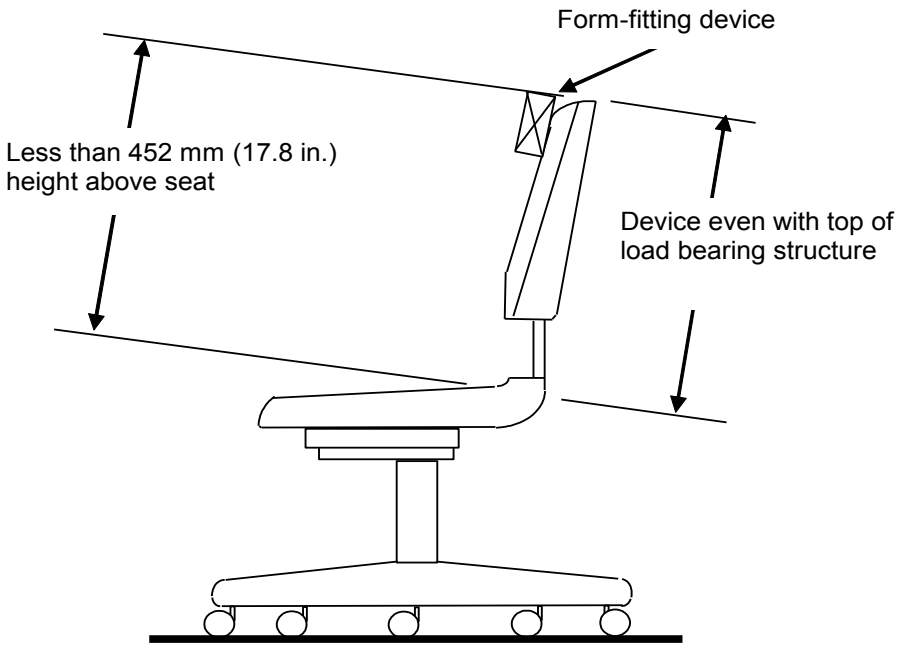



**Figure 5c - Positioning of Form-Fitting Device for Backrests Lower than 452 mm (17.8 in.) Backrest Strength Test - Static - Type I and II**

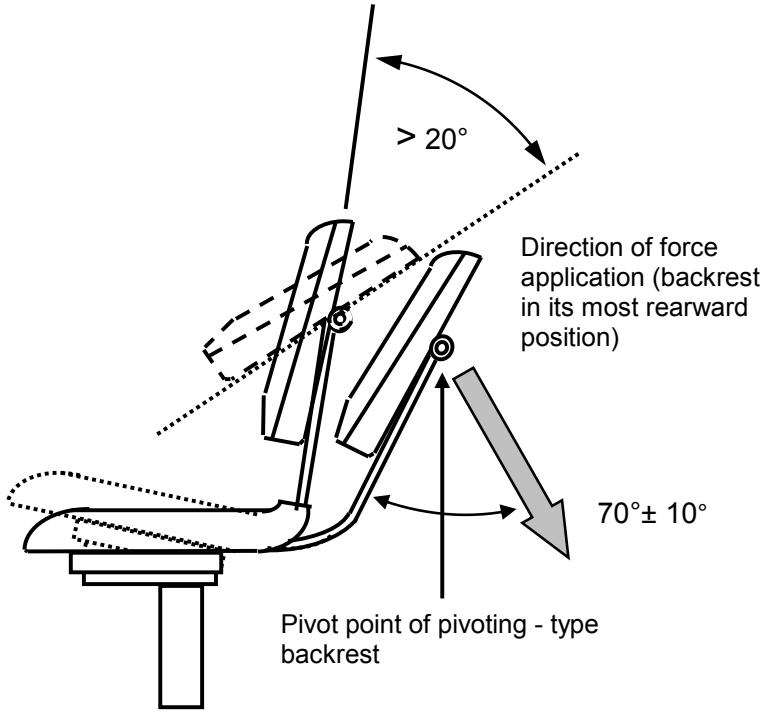



**Figure 5d - Force Application for Backrests that Pivot Greater than 20° Backrest Strength Test - Static - Type I**

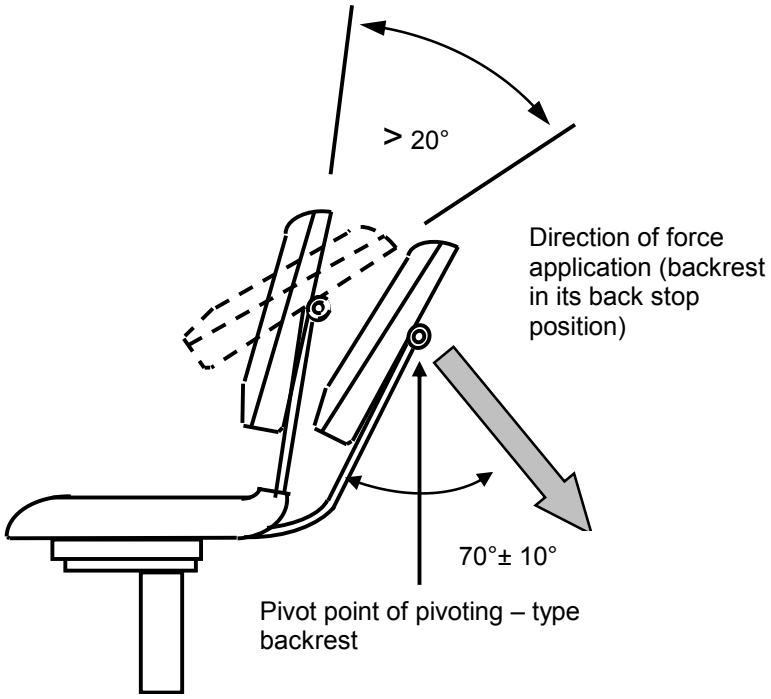



**Figure 5e - Force Application for Backrests that Pivot Greater than 20°**
**Backrest Strength Test - Static - Type II**

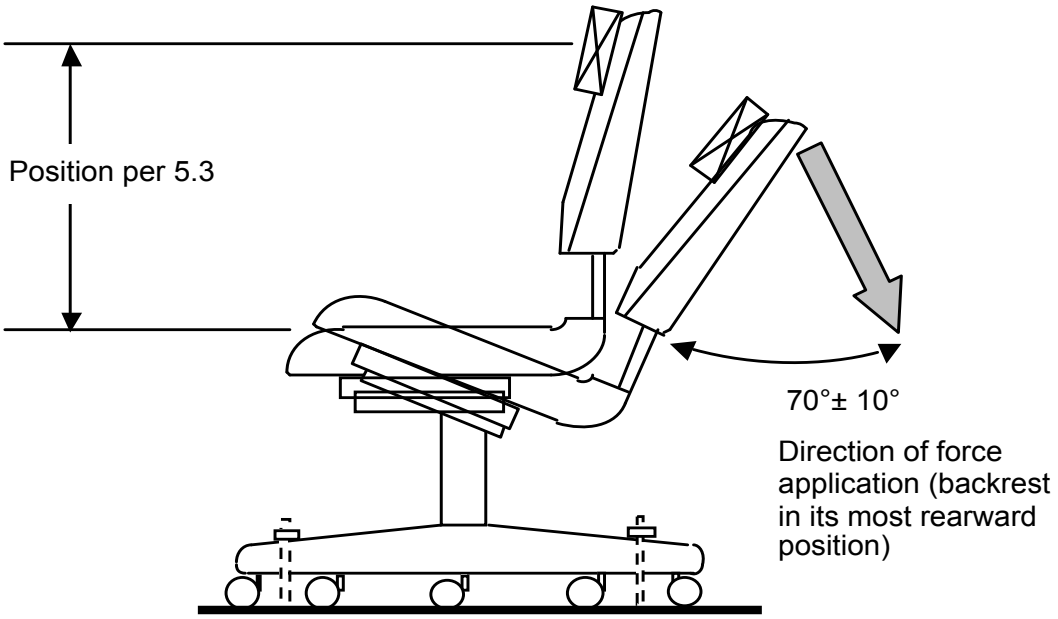



**Figure 5f - Force Application for All Other Backrests**
**Backrest Strength Test - Static - Type I**

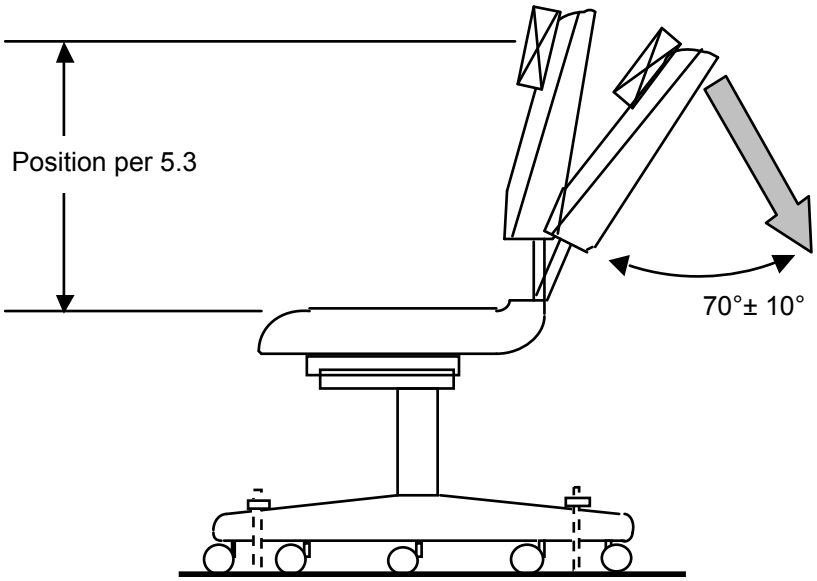



**Figure 5g - Force Application for All Other Backrests**
**Backrest Strength Test - Static - Type II**

## 5 Backrest Strength Test - Static - Type I and II (See Figures 5a through 5g)

### 5.1 Applicability

This backrest strength test shall be performed on Type I and II chairs. For chairs with tilt locks, locking the chair changes the chair type (See Section 4) and must also be tested according to Section 6 in the upright locked position. An additional chair may be used for the Section 6 testing.

**Note:** This test does not apply to chairs with backrest height less than 200 mm (7.9 in.).

### 5.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chair to withstand stresses such as those caused by the user exerting a rearward force on the backrest of the chair.

### 5.3 Test Setup

**5.3.1** The chair shall be placed on a test platform in an upright position and the base shall be restrained from movement, but shall not restrict movement of the backrest or arms of the chair. Figure 5f shows one acceptable method of restraining the chair. **Note**: For this test, the test platform may be placed at an angle to facilitate testing/load application.

**5.3.2** If adjustable features are available, all adjustments shall be set at normal use conditions, except for height-adjustable pivoting backrests which shall have the pivot point set at its maximum height or 406 mm (16.0 in.) whichever is less.

**5.3.3** After making the above adjustments, determine points 406 mm (16 in.) and 452 mm (17.8 in.) above the seat. (See Figure 5a and Section 3.5). Mark these points on the vertical centerline of the backrest.

a) If the top of the load-bearing structure/surface of the backrest is greater than or equal to 452 mm (17.8 in.) above the seat, position the center of the form-fitting device (See Definition 2.10) 406 mm (16 in.) above the seat. (See Figure 5b).

b) If the top of the load-bearing structure/surface of the backrest is less than 452 mm (17.8 in.) above the seat, position the top of the form-fitting device even with the top of the load-bearing structure/surface. (See Figure 5c).

c) If the unit has a pivoting backrest that stops at a position less than or equal to 20 degrees rearward (See Figures 5d and 5e), position the form-fitting device as directed in a) or b). If the unit has a pivoting backrest that stops at a position greater than 20 degrees rearward of the backrest, position the center of the form-fitting device at the height of the pivoting point. (See Figures 5d and 5e).

**5.3.4** Attach a loading device (front push or back pull) to the horizontal center of the backrest as determined above. With the backrest at its back stop position, apply a force that is initially 70 degrees ± 10 degrees to the plane of the backrest. (See Figures 5f and 5g). The force is not intended to be maintained at 70 degrees ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley.

**Note:** Where the design of the chair does not allow the transfer of force(s) from the form-fitting device to the load-bearing structure/surface, then a bridging device 38 mm to 102 mm (1.5 in. to 4 in.) in height may be used to span the width of the load-bearing structure/surface. For backrests with complex or varying contours, the plane of the backrest may be defined by the front of the CMD upright.

## 5.4 Test Procedures

### 5.4.1 Functional Load

a) A force of 667 N (150 lbf.) shall be applied to the backrest at the backstop position for one (1) minute. If the backrest/tilt lock mechanism will not accept the load due to gradual slipping of the adjustment mechanism during the load application, set the backrest to its most rearward (stopped) position, then apply the specified load(s).

b) Remove the load.

### 5.4.2 Proof Load

a) A force of 1001 N (225 lbf.) shall be applied to the backrest at the backstop position for one (1) minute. If the backrest/tilt lock mechanism will not accept the load due to gradual slipping of the adjustment mechanism during the load application, set the backrest to its most rearward (stopped) position, then apply the specified load(s).

b) Remove the load.

## 5.5 Acceptance Level

### 5.5.1 Functional Load

There shall be no loss of serviceability to the chair.

### 5.5.2 Proof Load

There shall be no sudden and major change in the structural integrity of the chair. Loss of serviceability is acceptable.

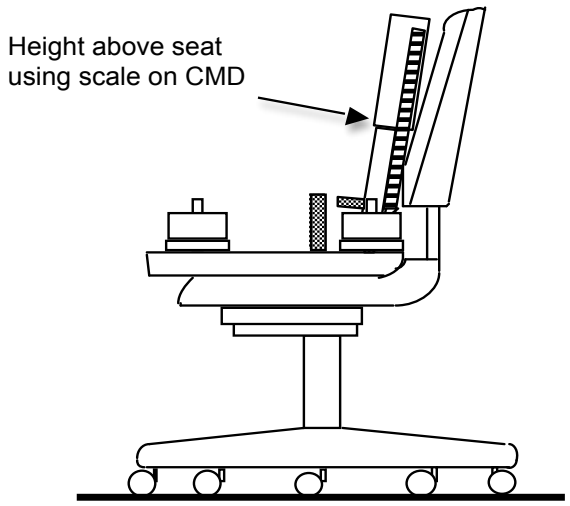



**Figure 6a - Height Determination
Backrest Strength Test - Static - Type III**

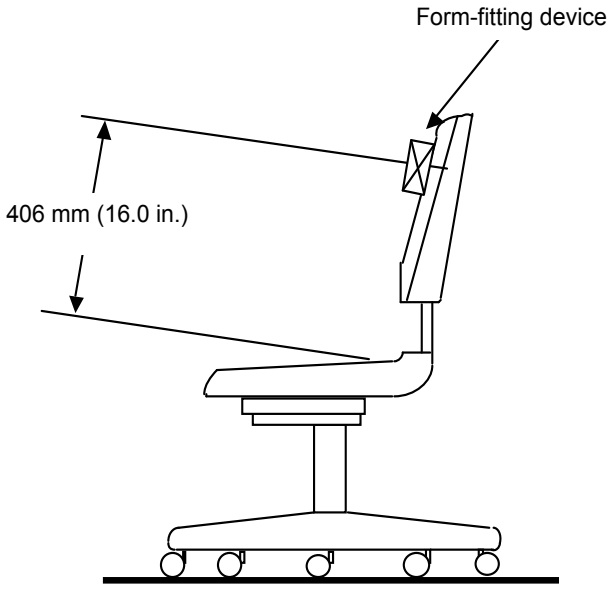



**Figure 6b - Positioning of Form-Fitting Device for Backrests Higher than 452 mm (17.8 in.) Backrest Strength Test - Static - Type III**

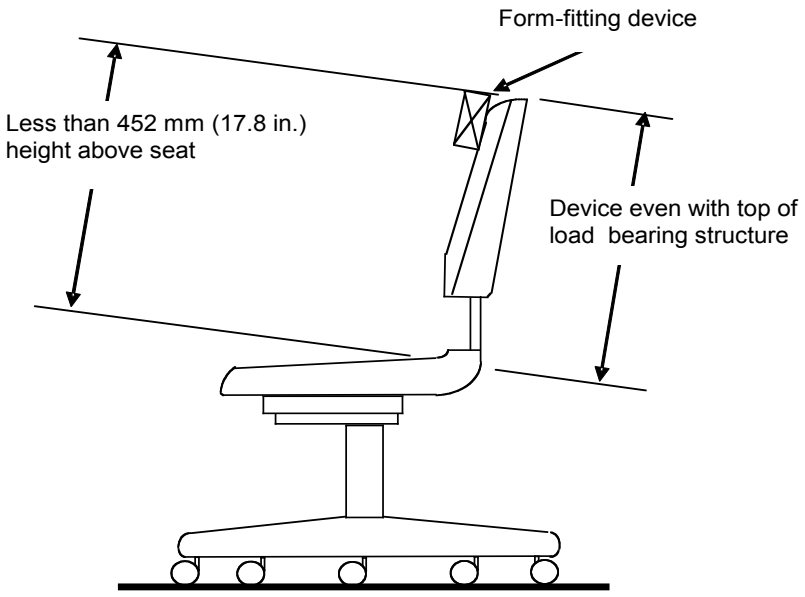



**Figure 6c - Positioning of Form-Fitting Device for Backrests Lower than 452 mm (17.8 in.) Backrest Strength Test – Static - Type III**

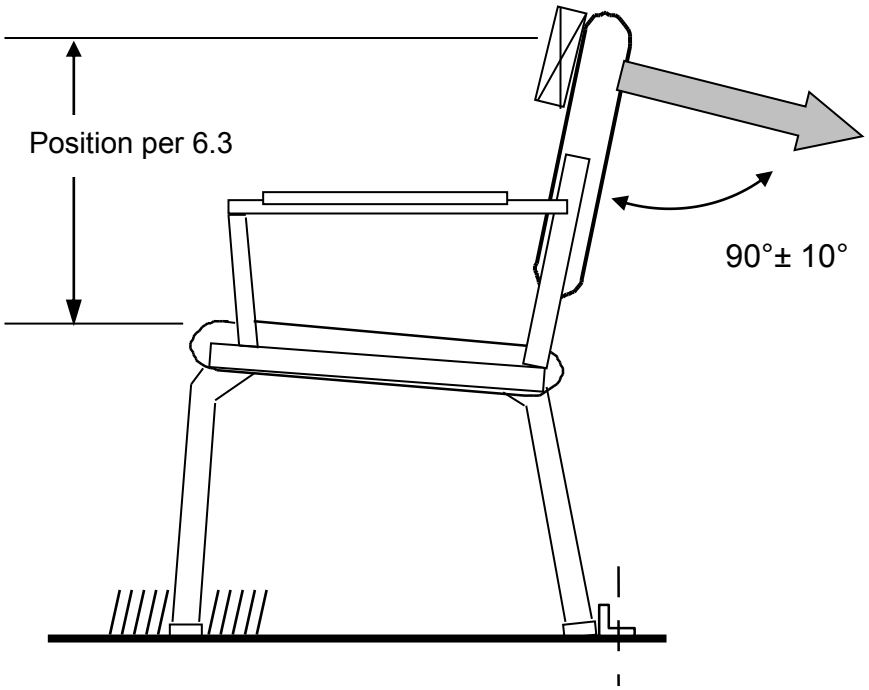



**Figure 6d - Force Application**
**Backrest Strength Test - Static - Type III**

## 6 Backrest Strength Test - Static - Type III (See Figures 6a through 6d)

### 6.1 Applicability

This backrest strength test shall be performed on Type III chairs with backrests greater than 200 mm (7.9 in.) in height.

### 6.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chair to withstand stresses such as those caused by the user exerting a rearward force on the backrest of the chair.

### 6.3 Test Setup

**6.3.1** The chair shall be placed on a test platform in an upright position and the base shall be restrained from movement, but shall not restrict movement of the backrest or arms of the chair. Figure 6d shows one acceptable method of restraining the chair.

**6.3.2** If adjustable features are available, all adjustments shall be set at normal use conditions, except for height-adjustable pivoting backrests which shall have the pivot point set at its maximum height or 406 mm (16.0 in.) whichever is less.

**6.3.3** After making the above adjustments, determine points 406 mm (16 in.) and 452 mm (17.8 in.) above the seat. (See Figure 6a and Section 3.5). Mark these points on the vertical centerline of the backrest.

a) If the top of the load-bearing structure/surface of the backrest is greater than or equal to 452 mm (17.8 in.) above the seat, position the center of the form-fitting device (See Definition 2.10) 406 mm (16 in.) above the seat. (See Figure 6b).

b) If the top of the load-bearing structure/surface of the backrest is less than 452 mm (17.8 in.) above the seat, position the top of the form-fitting device even with the top of the load-bearing structure/surface. (See Figure 6c).

**6.3.4** Attach a loading device (front push or back pull) to the horizontal center of the backrest as determined above. With the backrest at its back stop position, apply a force that is initially 90 degrees ± 10 degrees to the plane of the backrest (see Figure 6d). The force is not intended to be maintained at 90 ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley. The angle of the backrest plane may be determined by the angle of the plane of the front of the CMD upright.

**Note:** Where the design of the chair does not allow the transfer of force(s) from the form-fitting device to the load-bearing structure/surface, then a bridging device 38 mm to 102 mm (1.5 in. to 4 in.) in height may be used to span the width of the load-bearing structure/surface. For backrests with complex or varying contours, the plane of the backrest may be defined by the front of the CMD upright.

## 6.4 Test Procedures

### 6.4.1 Functional Load

a) A force of 667 N (150 lbf.) shall be applied to the backrest at the backstop position for one (1) minute. If the backrest/tilt lock mechanism will not accept the load due to gradual slipping of the adjustment mechanism during the load application, set the backrest to its most rearward (stopped) position, then apply the specified load(s).

b) Remove the load.

### 6.4.2 Proof Load

a) A force of 1001 N (225 lbf.) shall be applied to the backrest at the backstop position for one (1) minute. If the backrest/tilt lock mechanism will not accept the load due to gradual slipping of the adjustment mechanism during the load application, set the backrest to its most rearward (stopped) position, then apply the specified load(s).

b) Remove the load.

## 6.5 Acceptance Level

### 6.5.1 Functional Load

A functional load applied once shall cause no loss of serviceability to the chair.

### 6.5.2 Proof Load

A proof load applied once shall cause no sudden and major change in the structural integrity of the chair. Loss of serviceability is acceptable.

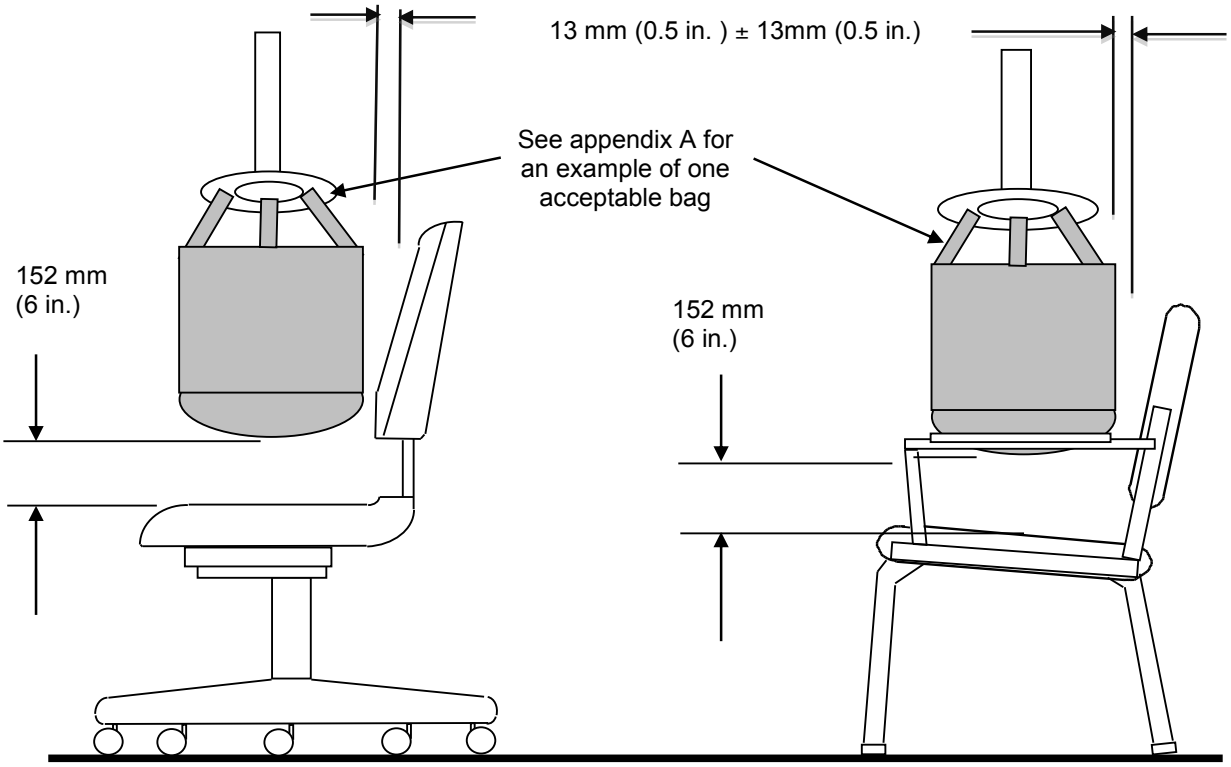



**Figure 7 - Drop Test - Dynamic**

## 7 Drop Test - Dynamic (See Figure 7)

### 7.1 Applicability

This test applies to all chair types.

### 7.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chair to withstand heavy and abusive impact forces on the seat.

### 7.3 Test Setup

a) The unit shall be placed on a test surface. **Note:** Care should be taken not to perform this test on platforms or other surfaces that may deform and/or lessen the impact.
    i) For the functional load test, clearance shall be provided such that the center column, if applicable, shall not touch the test platform (support the base on blocks or provide a clearance hole in the test platform).
    ii) For the proof load test, place the unit directly on the test platform. Additional clearance shall not be provided. **Note:** The chair base (center structure) may touch the test platform as a result of the impact load .

b) For chairs with a seat height adjustment feature, set the adjustment to its highest position. For chairs with glides that adjust greater than 50 mm (2.0 in), set them at 13 mm (0.5 in.) from their highest position. If other adjustable features are available, set these adjustments at normal use conditions. Casters, if present, shall be initially placed at the apparent worst-case position (typically at a position 90 degrees to the base leg). For pedestal base chairs, one of the base legs shall be set in the forward position (reference Figure 10b). **Note:** For chairs with lockable seat angles, the seat shall be tested in the unlocked position.

c) A 406 mm ± 13mm (16 in. ± 0.5 in.) diameter test bag containing appropriate media (steel shot, slugs, punches are typical – see Appendix A) weighing 102 kg (225 lb.) shall be attached to a device permitting a free fall to the seating position as shown in Figure 7.

d) The bag shall be centered side-to-side on the seat and shall be positioned 13 mm (0.5 in.) ± 13 mm (0.5 in.) from the most forward surface of the backrest during free fall. The bag shall not contact the backrest during the free fall.

### 7.4 Test Procedures

#### 7.4.1 Functional Load Test

a) The test bag shall be raised 152 mm (6 in.) above the uncompressed seat and released one time. The free fall distance shall be measured at the center of the drop bag. (See Figure 7).
b) Remove the bag.
c) For chairs with seat height adjustment features, set height to its lowest position and repeat a) and b).

#### 7.4.2 Proof Load Test

a) Repeat setup in 7.3 and increase the weight of the test bag to a proof load of 136 kg (300 lb.).
b) The test bag shall be raised 152 mm (6 in.) above the uncompressed seat and released one time. (See Figure 7).
c) Remove the bag.
d) For chairs with height adjustments, set seat height to its lowest position and repeat a) through c). A second chair may be used for testing the chair in the lowest position.

**Note:** If a second chair is used for the proof load test, it must also be subjected to the functional load impact per Section 7.4.1 while in its lowest position.

### 7.5 Acceptance Level

#### 7.5.1 Functional Load

There shall be no loss of serviceability.

#### 7.5.2 Proof Load

There shall be no sudden and major change in the structural integrity of the chair. Loss of serviceability is acceptable.

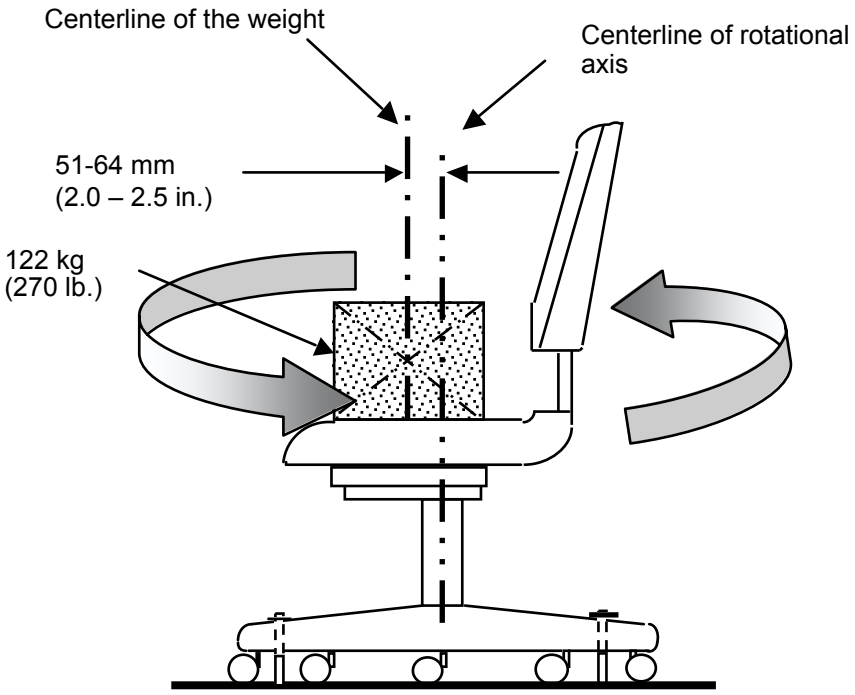



**Figure 8 - Swivel Test – Cyclic**

## 8 Swivel Test - Cyclic (See Figure 8)

### 8.1 Applicability

This test applies to all chair types with a swivel seat.

### 8.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chair to withstand stresses and wear of repeated swiveling.

### 8.3 Test Setup

a) The chair shall be restrained on a surface. Either the seat or the surface shall be restrained from rotation. Figure 8 shows one acceptable method of restraint.
b) If the seat height is adjustable, set it to the maximum seat height position. Set all other adjustable features to the normal use condition.
c) A 122 kg (270 lb.) load shall be placed on the seat such that the center of gravity of the load is 51 to 64 mm (2 to 2.5 in.) forward of the centerline of the rotational axis as shown in Figure 8.
d) The cycling device shall be adjusted to rotate the lesser of the following: the available range of rotation or 360 degrees ± 10 degrees. If the available range of rotation is less than 360 degrees, the rotation of the test machine shall be adjusted such that the swivel mechanism touches but does not override the stops. The rotation may be either bi-directional (alternating) or unidirectional.
e) For chairs that swivel 360 degrees, a cycle is one full rotation. For chairs that swivel less than 360 degrees, one cycle is rotating from one stop to the other stop.

### 8.4 Test Procedure

a) The seat or platform shall rotate for 60,000 cycles at a rate between 5 and 15 rotations per minute.
b) If the seat height is adjustable set the height to its lowest position.
c) For all chairs, continue the test for an additional 60,000 cycles to a total of 120,000 cycles.

### 8.5 Acceptance Level

There shall be no loss of serviceability.

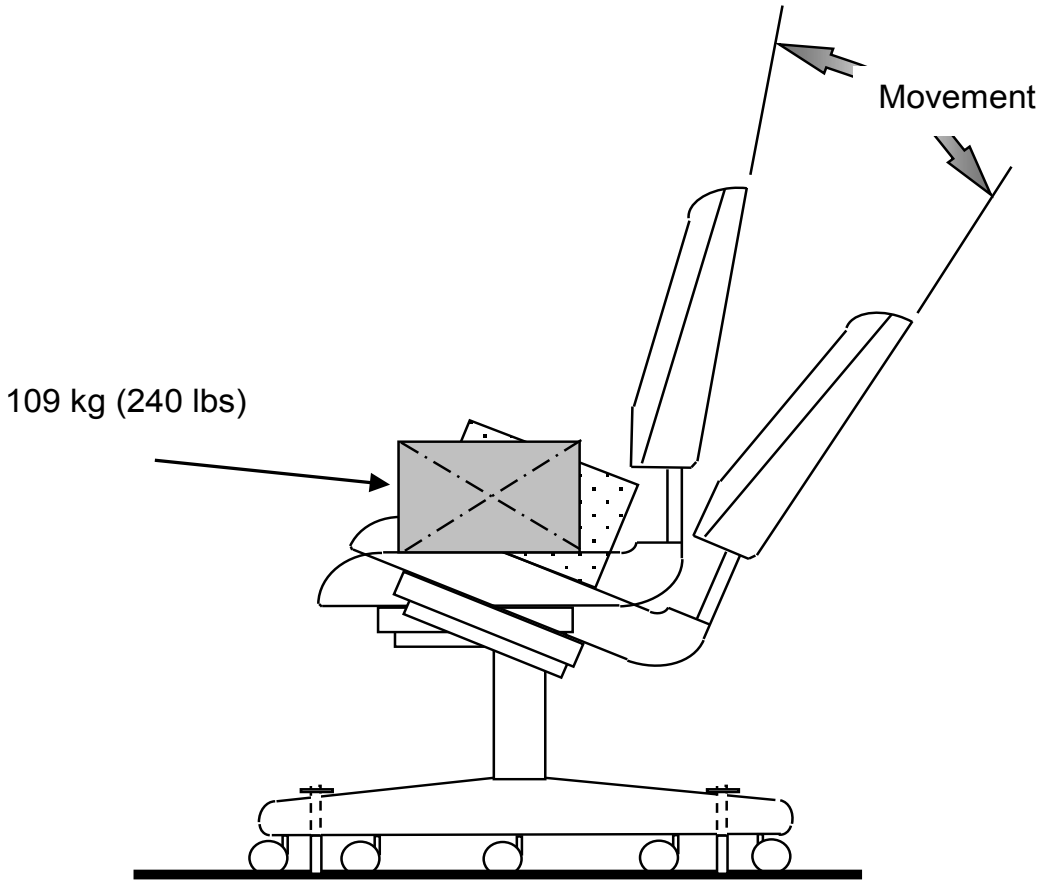



**Figure 9 - Tilt Mechanism Test - Cyclic**

## 9 Tilt Mechanism Test - Cyclic (See Figure 9)

### 9.1 Applicability

This test shall be performed on Type I and Type II chairs with tilting backrests.

### 9.2 Purpose of Test

The purpose of this test is to evaluate the ability of the tilt mechanism to withstand the fatigue stresses and wear caused by repeated tilting.

### 9.3 Test Setup

a) The chair or fixture with attached tilt mechanism shall be restrained on a test surface. Figure 9 shows one acceptable method of restraint.
b) If adjustable features are available, all adjustments shall be set at normal use conditions.
c) A cycling device shall be attached to the chair or fixture at any location appropriate to apply a controlled (push and/or pull) motion.
d) A test load of 109 kg (240 lbs.) shall remain on the center of the seat (or equivalent location on the fixture) and secured if necessary.
e) Adjust the cycling device to move the mechanism between the front and back stops, without overriding or impacting either stop.

### 9.4 Test Procedure

The unit shall be cycled for 300,000 cycles at a rate between 10 and 30 cycles per minute. The tilt mechanism and/or cycling device should be checked and readjusted as needed to maintain the original conditions specified.

### 9.5 Acceptance Level

There shall be no loss of serviceability to the tilt mechanism.

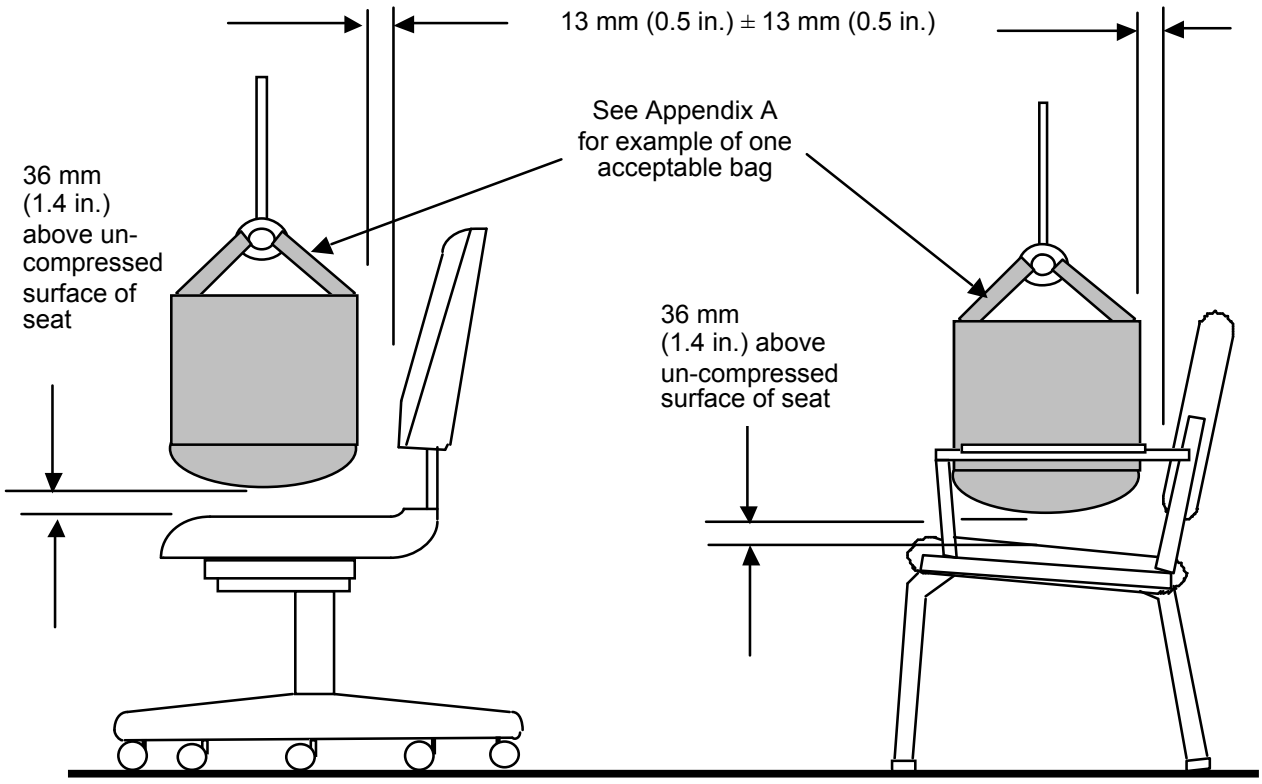
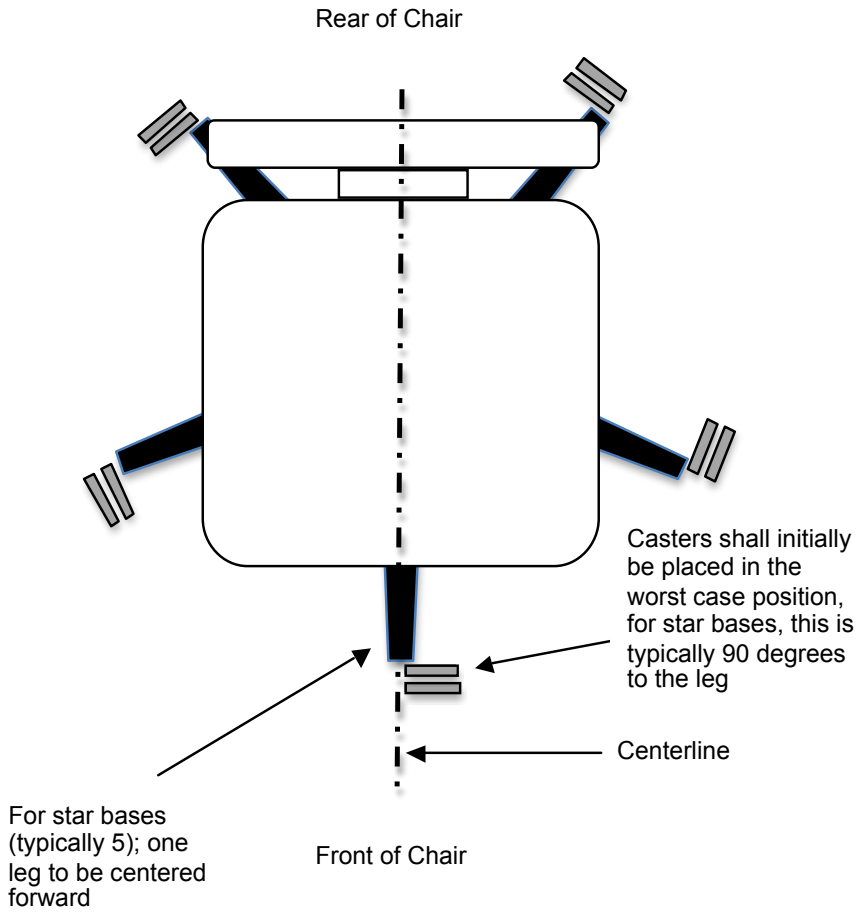
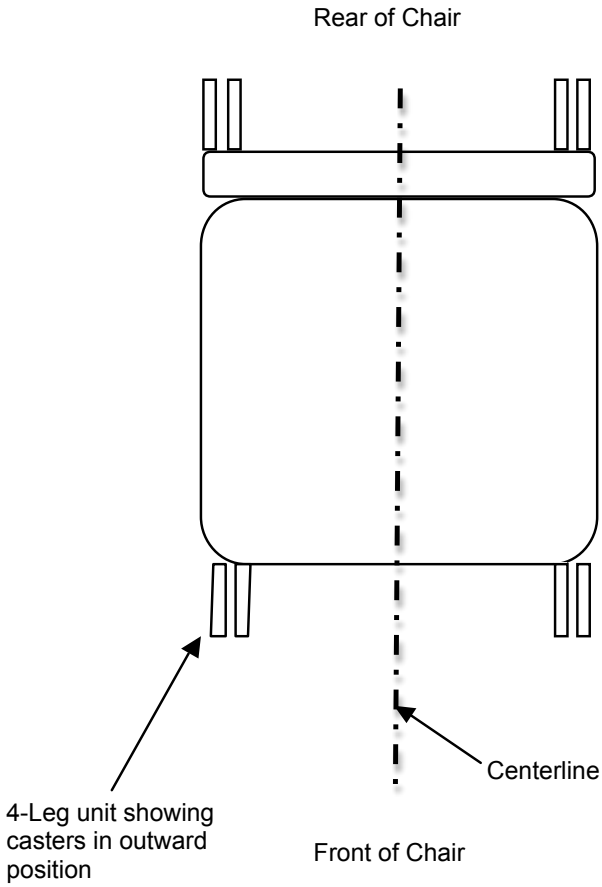



**Figure 10a - Seating Durability Test - Cyclic**




**Top View of Chair**

**Figure 10b - Seating Durability Test – Caster Position 5-star Base**




**Top View of Chair**

**Figure 10c - Seating Durability Test – Caster Position 4-Leg Base**

## 10 Seating Durability Tests – Cyclic (See Figures 10a, 10b, 10c, and 10d)

**Note:** This is a two-part test. The impact test and front corner load-ease tests must be run sequentially on the same sample for this evaluation.

### 10.1 Applicability

These tests apply to all chair types.

### 10.2 Purpose of Tests

The purpose of these tests is to evaluate the ability of chairs to withstand fatigue stresses and wear caused by downward vertical force(s) on the seat.

### 10.3 Impact Test

#### 10.3.1 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 chair, or inhibit movement of the chair response to the impact. For pedestal base chairs, one of base legs shall be maintained in the forward position throughout the test (see Figure 10b). Casters, if present, shall be initially placed at the apparent worst-case position (See Fig. 10b). For four-leg-base chairs, initially position the casters parallel to the front to rear centerline of the chair in their most outward position. (See Fig. 10c).

b) If adjustable features are available, all adjustments shall be set at normal use conditions.
**Note:** For chairs with lockable seat angles, the seat shall be tested in the unlocked position.

c) Chairs 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 ± 6 mm (2 in. ± 0.25 in.). Any additional foam added to the top of the seat shall have a 25% Indentation Force Deflection (IFD) of 200 N ± 22 N (45 lbf. ± 5 lbf.).[1]
**Note:** Flexible seat surfaces (i.e., mesh, flexible plastic, etc.) are not considered cushioning materials; foam shall be added to these surfaces.

d) A 406 mm ± 13mm (16 in. ± 0.5 in.) diameter test bag containing metal media weighing 57 kg (125 lb.) shall be attached to a cycling device, permitting a free fall to the seat as shown in Figure 10a. The drop height and/or seat height shall be adjusted during the test if the drop height changes by more than 13 mm (0.5 in.). The cycling device shall be set at a rate between 10 and 30 cycles per minute.

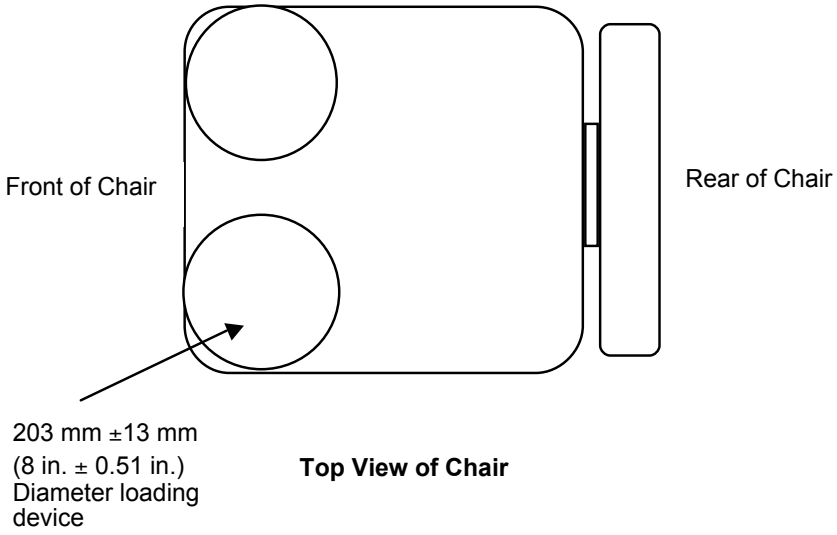
e) The bag shall be centered side-to-side on the seat and shall be 13 mm (0.5 in.) ± 13 mm (0.5 in.) from the most forward surface of the backrest during free fall. The bag shall not contact the backrest during the free fall.

[1] Specimen thickness 102 mm (4 in.). See Method $B_1$, Indentation Force Deflection Test, in *Standard Test Methods for Flexible Cellular Materials —Slab, Bonded, and Molded Urethane Foams*, ASTM D 3574..

f) The free fall shall begin after lifting the test bag 36 mm (1.4 in.) above the uncompressed surface on the seat (or uncompressed top of the foam, if added), as measured at the center of the drop bag.

**10.3.2 Test Procedure**

The chair shall be tested to 100,000 cycles.



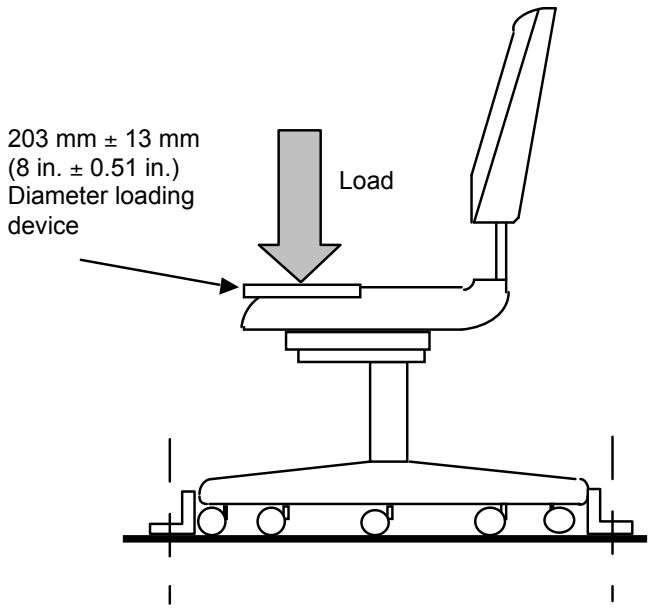




**Figure 10d - Front Corner Load-Ease Test - Cyclic - Off-center**

### 10.4 Front Corner Load-Ease Test – Cyclic – Off-center

#### 10.4.1 Test Setup

After completing the impact test in Section 10.3, apply a force of 890 N (200 lbf.) through a 203 mm ± 13 mm (8 in. ± 0.51 in.) diameter loading device at one front corner flush to each structural edge. If arms interfere with the placement of the loading device and are intended to be removable, they shall be removed for this test. If arms interfere but are not removable (or adjustable) the loading device shall be positioned to avoid interference. If cushion material was used during impact testing (10.3.1c) it may remain in place during this testing to avoid uneven/point loading of the seat.

#### 10.4.2 Test Procedure

Raise the loading device from the seat and lower completely, without impact to the seat so that it takes the entire load without any support from the cycling device, at a rate of 10 to 30 cycles per minute. Test for 20,000 cycles. Reposition the load to the other front corner, and perform the test for an additional 20,000 cycles.

**Note:** Applying the loads in an alternating sequence to attain a total of 40,000 cycles is an acceptable method of performing this test.

### 10.5 Acceptance Level

There shall be no loss of serviceability to the chair after completion of both the impact and load-ease tests. If applicable, the chair base (center structure) shall not touch the test platform as a result of the impact loads.

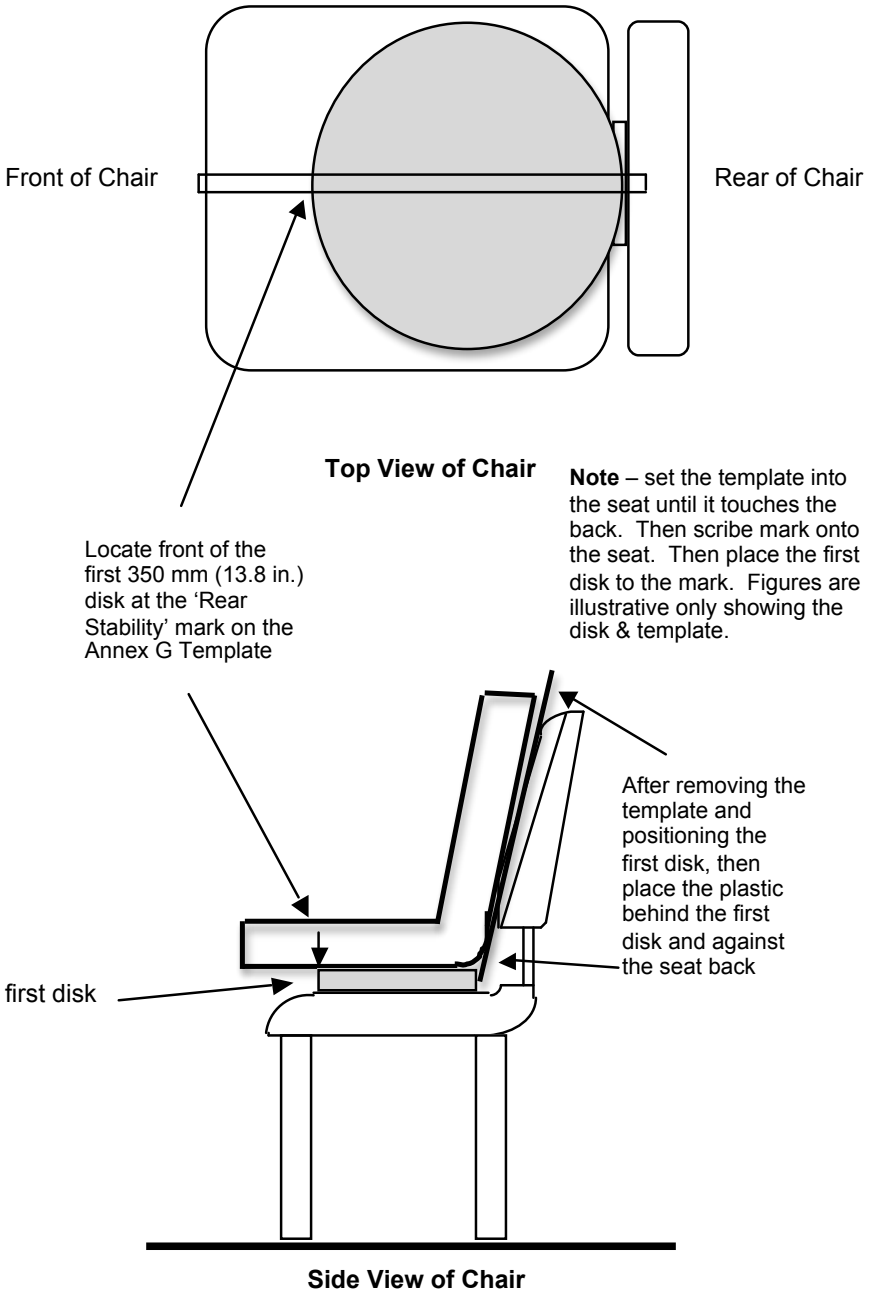
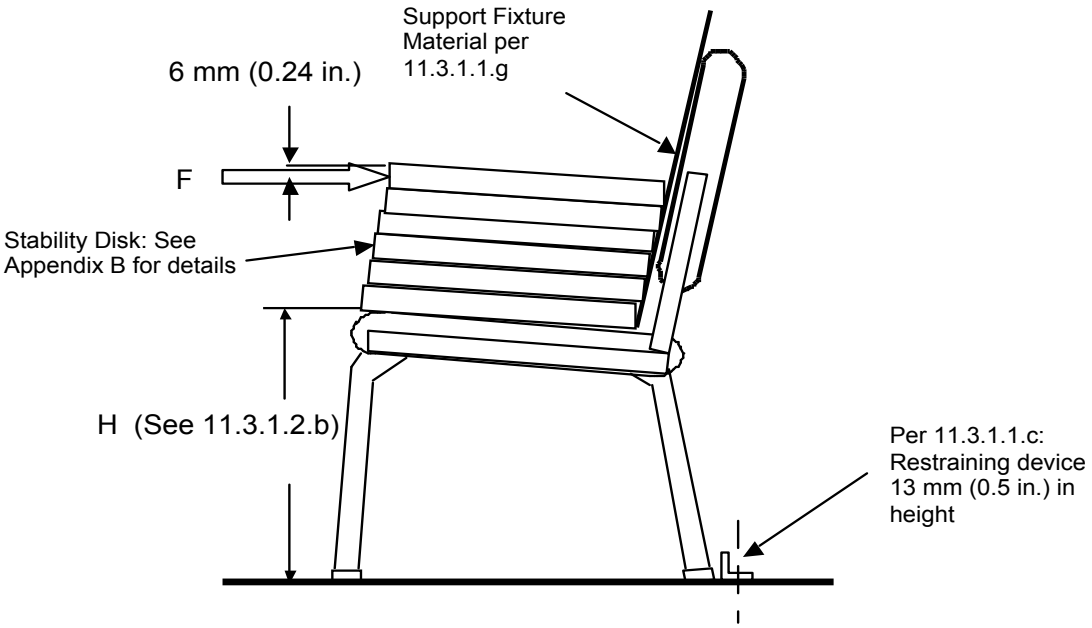
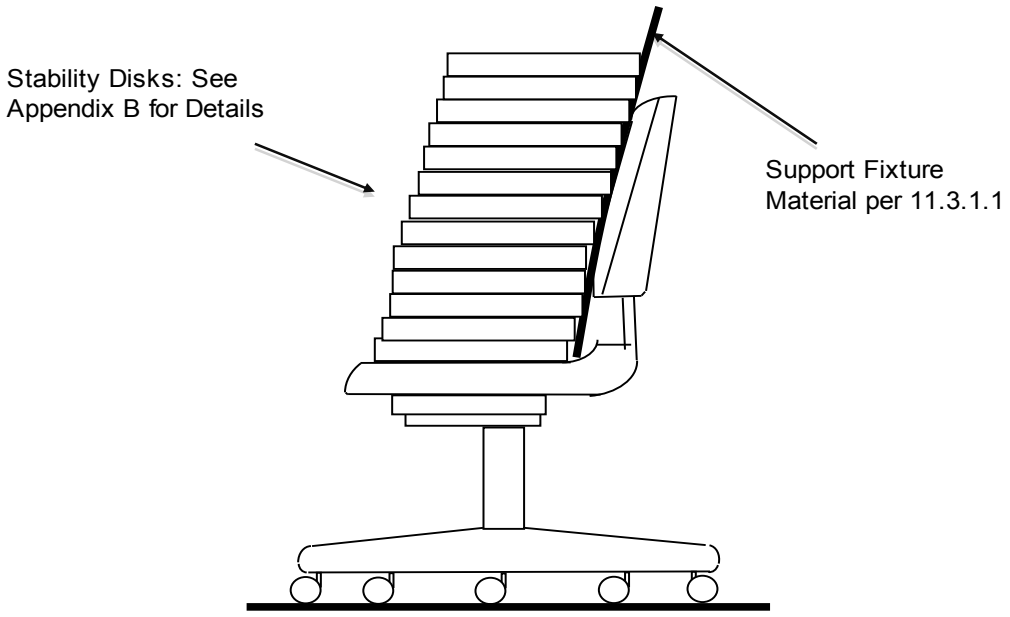



**Figure 11a – Rear Stability First Disk Placement**




**Rear Stability Test for Type III Chairs**




**Rear Stability Test for Type I and II Chairs**

**Figure 11b – Rear Stability Tests**

# 11 Stability Tests

## 11.1 Applicability

The stability tests shall be performed on all types of chairs.

**Note:** Rearward stability tests apply only to chairs with backrests greater than 200 mm (7.9 in.) in height as measured with the CMD (See Section 3.5).

## 11.2 Purpose of Tests

The purpose of these tests is to evaluate the front and rear stability of chairs.

## 11.3 Rear Stability

### 11.3.1 Rear Stability Test for Type III Chairs (See Figures 11a and 11b)

**Note:** If a chair needs to be tested as more than one type, it is recommended that it be tested in the sequence given. If tested out of sequence (or individually by type) all weights must be entirely removed from the chair before starting each test.

#### 11.3.1.1 Test Setup

a) The unit shall be placed on a test platform.

b) On units with adjustable features, all adjustments shall be set at the apparent least stable condition for rearward stability such as,

   i) maximum height of seat or backrest, or both,

   ii) rearmost seat or backrest position, or both,

   iii) the least stable condition of casters or glides and tilt mechanism.

c) For chairs with casters, a block or obstruction 13 mm (0.5 in.) in height shall be affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. The block shall prevent sliding but not interfere with the caster hood such that it restricts the unit from tipping – in such cases, a lower height obstruction may be used as long as it prevents sliding. On units that rotate, the bases and casters, if any, shall be positioned to offer the least resistance to backward tipping of the unit.

d) For chairs without casters, a block or obstruction 13 mm (0.5 in.) in height shall be affixed to the test platform. On units that rotate, the base shall be positioned to offer the least resistance to backward tipping of the unit.

e) For chairs with tilt locks, locking the mechanism in the near upright position changes the chair type (See Section 4: Chair Types) and the chair shall be tested in the locked (near upright) condition and in the unlocked (reclined) condition as per Section 11.3.2.

f) Place the first disk into the seat using the Template from Appendix G. Make a mark on the seat at the Rear Stability mark on the template. Remove the template and place the front of the first disk at this mark. See Figure 11a. If the seat depth does not allow for direct transfer of the mark on the template to the seat, use alternate means to properly determine the correct disk placement.

g) Place a support fixture made of a 1.5 mm ± 0.15 mm (0.060 in. ± 0.006 in.) thick polypropylene, 356 mm (14 in.) wide and 711 mm (28 in.) tall against the chair back so that it approximates the contour of the back.

**11.3.1.2 Test Procedure**

a) Load the chair with the remaining 5 disks (See Appendix B). Place the second disk on the seat so it touches the support fixture. As each disk is added to the stack slide it along the lower disk until it contacts the support fixture as shown in Figure 11b. As each disk is added, the backrest may move such that the lower disks do not remain against the support fixture; this is acceptable, do not reposition the disks.

   **Note:** For chairs that do not allow the disk to settle evenly into the plane of the seat (e.g. deeply contoured hard plastic seat pans), up to 25 mm (1 in.) of foam (25% Indentation Force Deflection (IFD) of 200 N ± 22 N (45 lbf. ± 5 lbf.) may be placed under the first disk.

b) Apply a rearward force parallel to the top surface of the highest disk. The location of the force application is 6 mm (0.25 in.) from the top of the disk. (See Figure 11b).

   For chairs with seat height (as measured at the front of the bottom of the lowest disk when all disks are in the chair) less than 710 mm (28.0 in.), calculate the force as follows:

   F = 0.1964 (1195 – H) Newton. H is the seat height in mm. (F = 1.1 (47 – H) pounds force. H is the seat height in inches.)

   For chairs with seat height equal to or greater than 710 mm (28.0 in.), a fixed force of 93 N (20.9 lbf.) shall be applied.

**11.3.1.3 Acceptance level**

The chair shall not tip over.

**11.3.2 Rear Stability Test for Type I and II Chairs** (Figures 11a and 11b)

**Note:** For chairs with tilt locks, locking the chair changes the chair type (See Section 4) and must also be tested according to Section 11.3.1 in the upright locked position.

**11.3.2.1 Test Setup**

a) The chair shall be placed on a test platform. A block, obstruction or other restraining device 13 mm (0.5 in.) in height shall be affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. On chairs that rotate, the base and casters shall be positioned to offer the least resistance to rearward tipping of the chair.

b) On chairs with adjustable features, all adjustments shall be set at the apparent least stable condition for rearward stability, such as:
   i) maximum height of seat or backrest, or both,
   ii) minimum tension of tilt mechanism,
   iii) rearmost seat or backrest position, or both,

c) Place the first disk into the seat using the Template from Appendix G. Make a mark on the seat at the Rear Stability mark on the template. Remove the template and place the front of the first disk at this mark. See Figure 11a. **Note:** Use of the Template is preferred, however, it is acceptable to estimate the location of the first disk by placing it in the seat without the template. The first disk should touch the support fixture per 11.3.2.1.d.

d) Place a support fixture made of a 1.5 mm ± 0.15 mm (0.060 in. ± 0.006 in.) thick polypropylene, 356 mm (14 in.) wide and 711 mm (28 in.) tall so that it touches the seat, back side of the first loading disk and touches the chair back. The intent of the support fixture is to allow the disks to place a load on the chair back in a way that would simulate a person leaning on the back. When loaded, there should be no significant gaps between the chair back and the support fixture.

**11.3.2.2 Test Procedure**

Place the second disk in the chair until it touches the plastic. Tilt the chair to its approximate tilt stop (most rearward position). Pull back on the backrest until it reaches its full-tilt position, then

load the chair with the remaining 11 disks (for a total of 13 disks). As each disk is added to the stack slide it along the lower disk until it contacts the support fixture as shown in Figure 11b. Do not allow the momentum of the mass during disk application to cause tipover of the chair. Only the mass in the chair at the tilt stop position shall determine the pass/fail condition of the chair.

If the chair does not tip over and the tilt mechanism does not remain tilted as a result of the additional force to position the chair at its most rearward position (i.e., at its tilt stop) when the disks are placed in the chair, the chair shall also be tested according to 11.3.1 with the chair in the unlocked position.

**Note:** For chairs that do not allow the disk to settle evenly into the plane of the seat (e.g. deeply contoured hard plastic seat pans), up to 25 mm (1 in.) of foam (25% Indentation Force Deflection (IFD) of 200 N ± 22 N (45 lbf. ± 5 lbf.)) may be placed under the first disk.

**11.3.2.3 Acceptance level**

The chair shall not tip over.

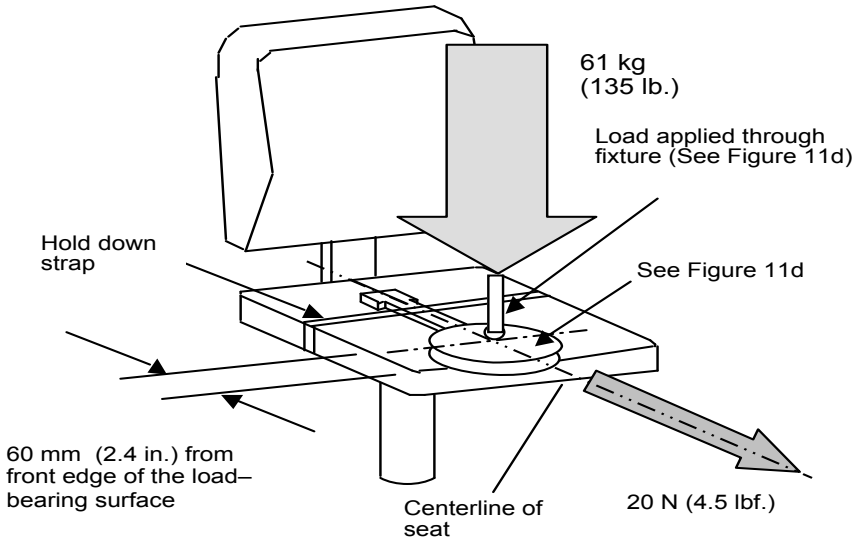



**Figure 11c - Front Stability Test**

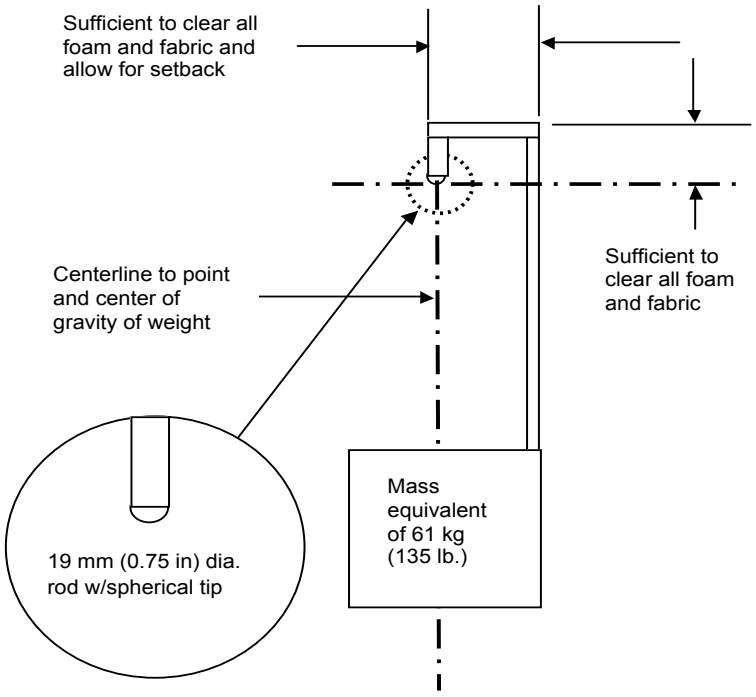
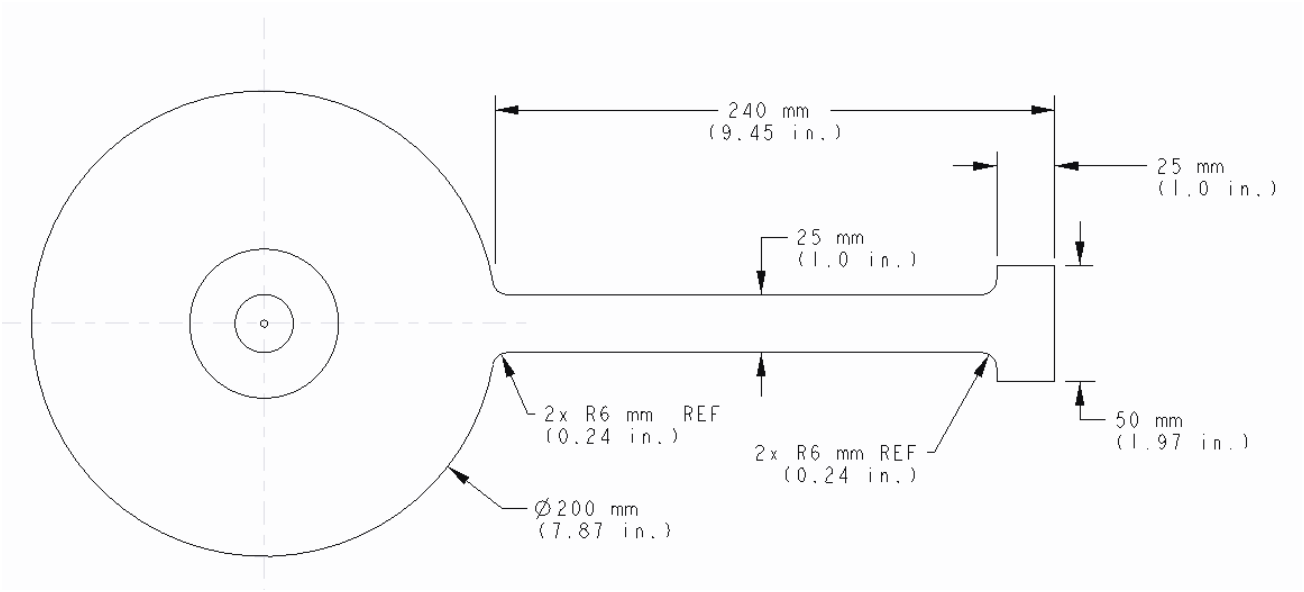
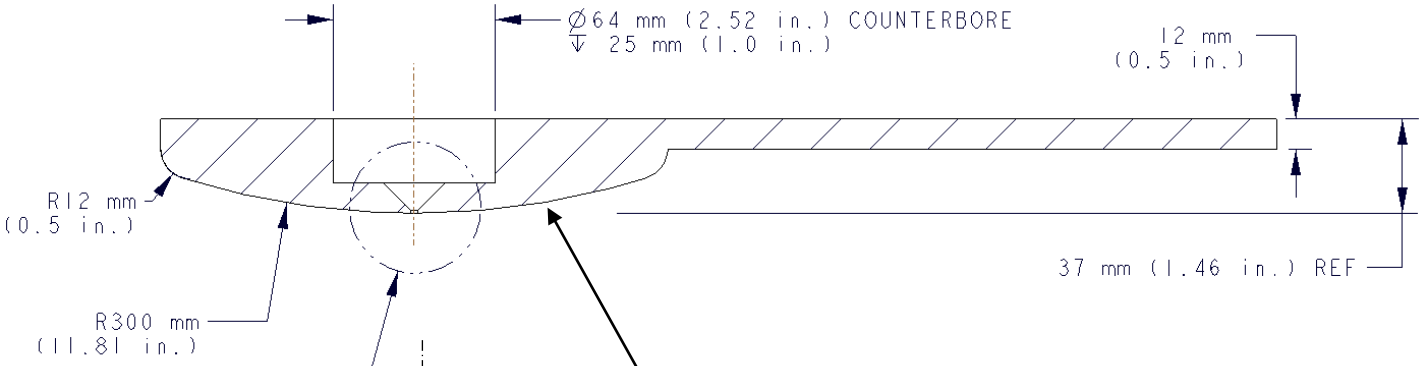
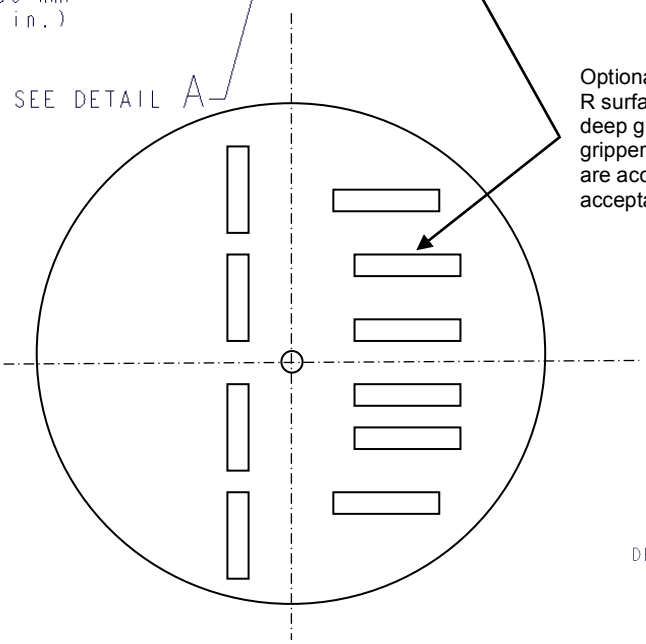



**Figure 11d - Front Stability Loading Fixture**




Optional - Carpet stretcher grip material on 300 mm (11.81 in.) R surface. To be recessed into approximately a 2 mm (0.08 in.) deep groove so that only the gripper teeth protrude. The carpet gripper placement shown is one example, other configurations are acceptable. Use of thin friction cloth / pads are also acceptable.

**Material – Nylon or ABS**
Weight to be 1.07 ± 0.40 kg
(2.36 ± 0.88 lb.)

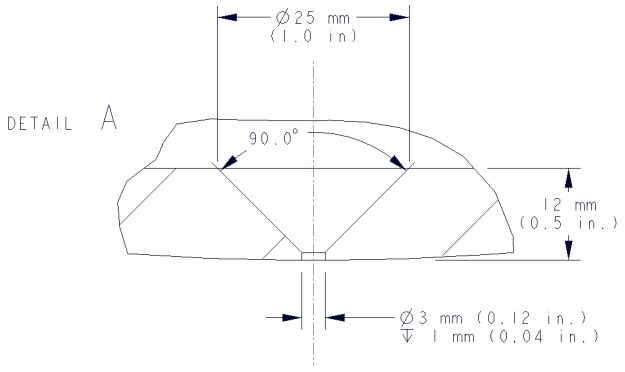



**Figure 11e - Front Stability Loading Disk**

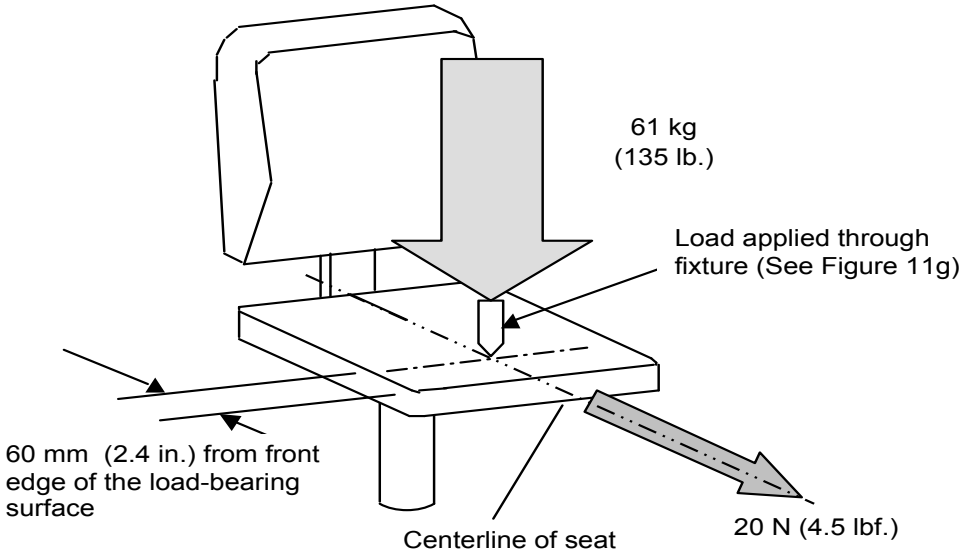



**Figure 11f - Front Stability Test**

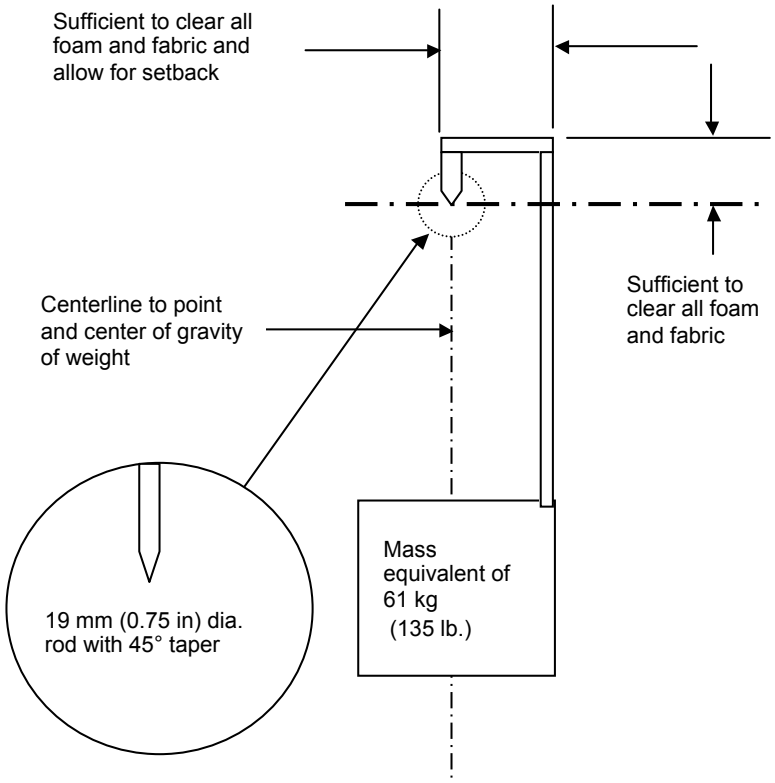



**Figure 11g - Front Stability Loading Fixture**

## 11.4 Front Stability

Front stability shall be determined by either the method described in Sections 11.4.1 and 11.4.2 or 11.4.1 and 11.4.3.

### 11.4.1 Test Setup

a) The unit shall be placed on a test platform.
b) On units with adjustable features, all adjustments shall be set at the apparent least stable condition for forward stability, such as, maximum height of seat or backrest, or both, most forward seat or backrest position or both, and at the least stable condition of casters, glides and tilt mechanism.
c) For chairs with casters, a block or obstruction 13 mm (0.5 in.) in height shall be affixed to the test platform. The device shall prevent sliding but not restrict the unit from tipping. The block shall prevent sliding but not interfere with the caster hood such that it restricts the unit from tipping – in such cases, a lower height obstruction may be used as long as it prevents sliding. On units that rotate, the bases and casters, if any, shall be positioned to offer the least resistance to forward tipping of the unit.
d) For chairs without casters, a block or obstruction 13 mm (0.5 in.) in height shall be affixed to the test platform. On units that rotate, the base shall be positioned to offer the least resistance to forward tipping of the unit.

### 11.4.2 Test Procedure (See Figures 11c and 11d).

a) Apply a vertical load of 61 kg (135 lb.), through the front-stability loading disk (See Figure 11e), so that the center if the disk portion is 60 mm (2.4 in.) from the front center edge of the load-bearing surface of the seat. **Note:** It is recommended that the fixture/method shown in Appendix D be used to assist in locating the 60 mm (2.4 in.) loading dimension. If using the fixture, the vertical height of the fixture should allow contact at the approximate center of the sloped face of the fixture with the tangent (touch point) on the front of the seat.
b) Apply a horizontal force of 20 N (4.5 lbf.) at the same height that the vertical force is applied (at the point of contact of the loading fixture). The force shall be coincident (in-line) with the side-to-side centerline of the seat.

### 11.4.3 Test Procedure - Alternate (See Figures 11f and 11g)

a) This alternate method may be used on chairs that have a seat surface that will support the stability loading fixture without the use of the front-stability loading disk(i.e., hard surfaced seats or seats with minimal cushion).

b) Apply a vertical load of 61 kg (135 lb.), by means of the front stability loading fixture shown in Figure 11g at a point 60 mm (2.4 in.) from the front center edge of the load-bearing surface of the chair. **Note:** It is recommended that the fixture/method shown in Appendix D be used to assist in locating the 60 mm (2.4 in.) loading dimension.

c) Apply a horizontal force of 20 N (4.5 lbf.) at the same height that the vertical force is applied (at the point of contact of the loading fixture). The force shall be coincident (in-line) with the side-to-side centerline of the seat.

### 11.4.4 Acceptance Level

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

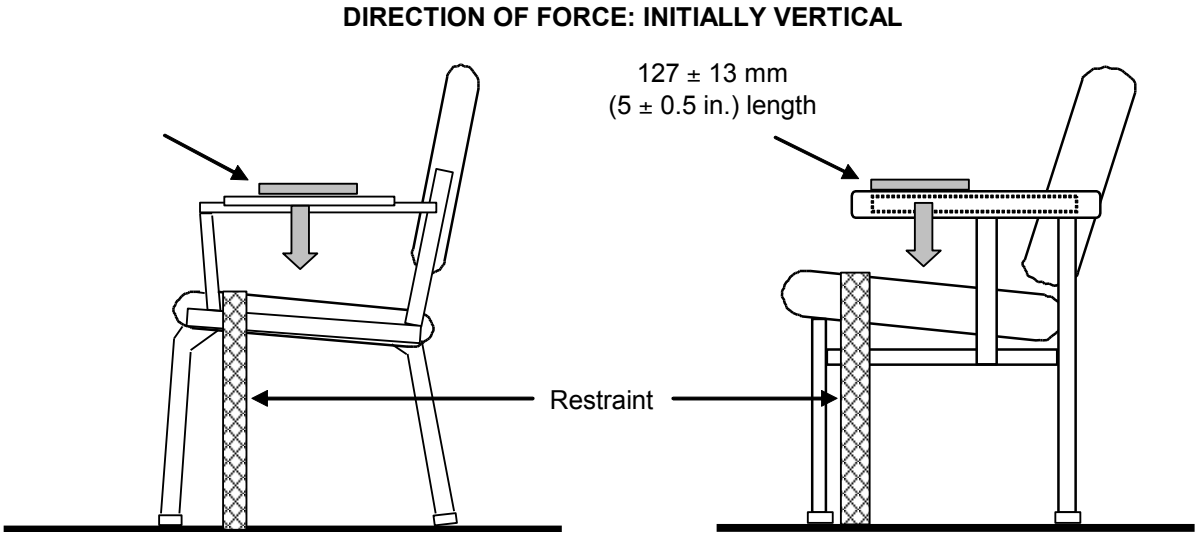



**Figure 12a - Arm Strength Test - Vertical - Static**

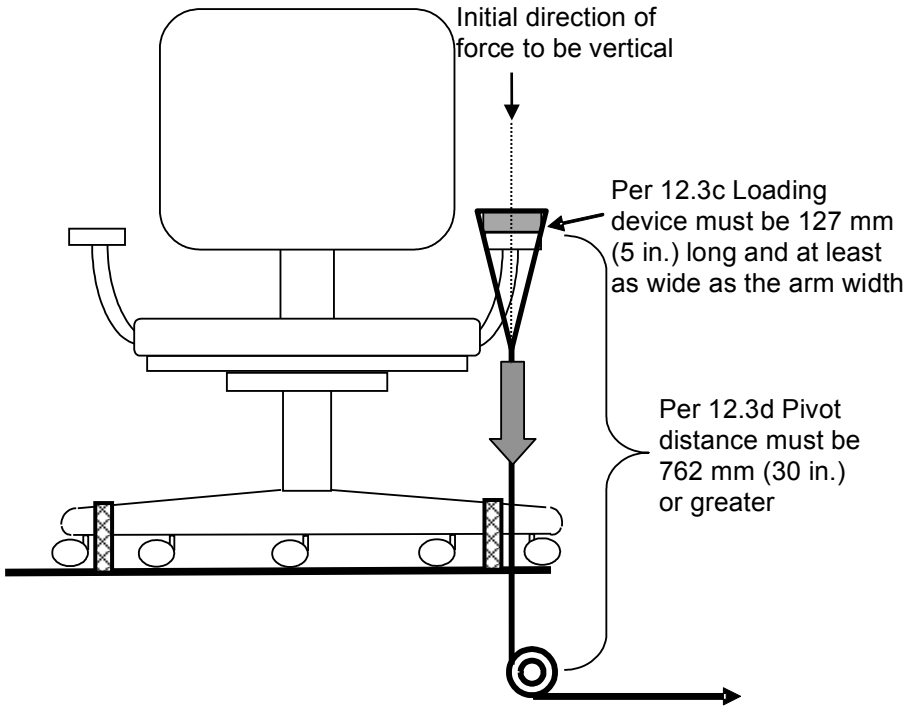



**Figure 12b - Arm Strength Test - Vertical – Static**

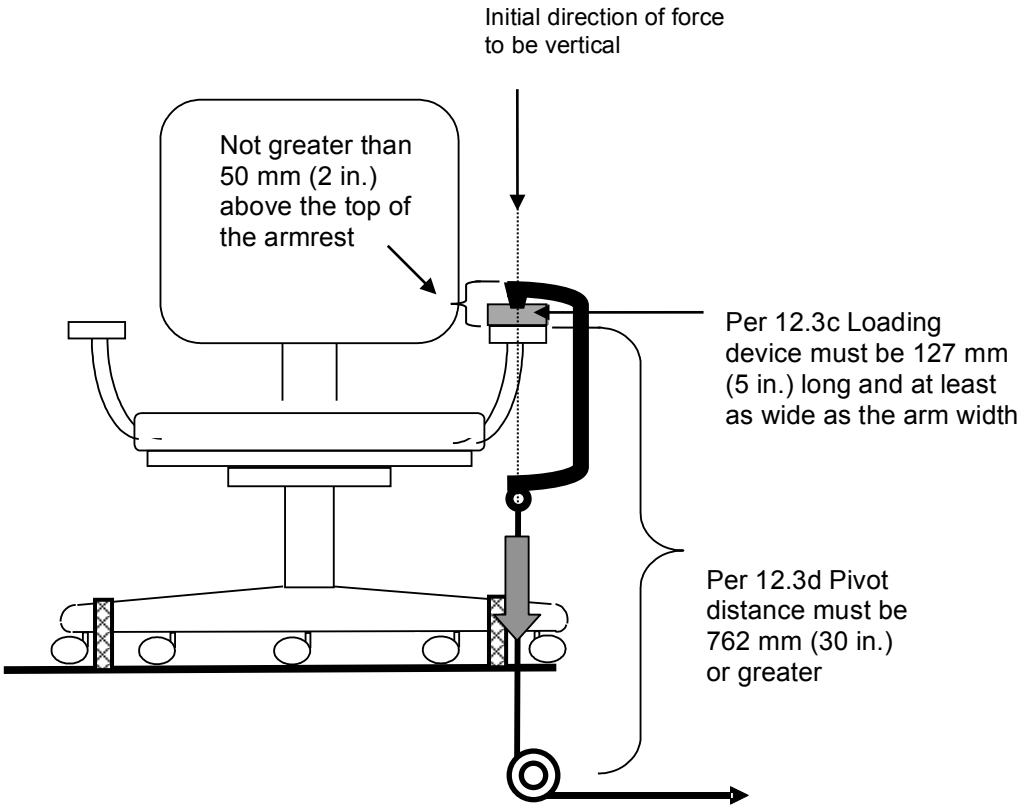



**Figure 12c - Arm Strength Test - Vertical – Static ("C" Fixture Method)**

## 12 Arm Strength Test - Vertical - Static (See Figures 12a, 12b, and 12c)

### 12.1 Applicability

This test applies to all chairs with arms.

### 12.2 Purpose of Test

The purpose of the test is to evaluate the ability of a chair and arm to withstand stresses caused by applying vertical forces on the arm(s).

### 12.3 Test Setup

a) The chair shall be placed on a test platform and restrained from movement, including rotational movement of the seat. Blocking movement of the chair shall not provide a counterbalancing force that aids the support structure of the armrest under load and/or chair control/tilt mechanism. Type III chairs may be restrained using the seating surface (see Figure 12a).

b) If adjustable features are available, all adjustments shall be set at normal use conditions.

c) A loading adapter that is 127 mm (5 in.) long and at least as wide as the width of the arm shall be attached to the top of the arm rest structure such that the load will be applied at the apparent weakest point that is forward of the front of the chair's backrest (at the height of the top of the armrest).

d) Apply an initially vertical pull force to the load adapter using a mechanism, such as a cable and pulley, having a pivot point 762 mm (30 in.) or greater below the arm. The attachment to the load adapter shall not be greater than 50 mm (2 in.) above the top of the armrest (See Figure 12b). The mechanism must allow the arm to deflect or pivot as a result of the load application. If the chair design does not allow pull force application, other methods of applying the load are acceptable as long as they allow the arm to deflect or pivot as a result of the load application.

### 12.4 Test Procedures

#### 12.4.1 Functional Load

a) A force of 750 N (169 lbf.) shall be applied for one (1) minute.

b) Remove the force.

#### 12.4.2 Proof Load

a) A force of 1125 N (253 lbf.) shall be applied for 15 seconds.

b) Remove the force.

### 12.5 Acceptance Level

#### 12.5.1 Functional Load

There shall be no loss of serviceability. For a height adjustable arm, failure to hold its height adjustment position to within 6 mm (0.25 in.) from its original set position as the result of the loading is considered a loss of serviceability.

#### 12.5.2 Proof Load

There shall be no sudden and major change in the structural integrity of the chair. For a height adjustable arm, a sudden drop in height of greater than 25 mm (1 in.) does not meet this requirement. Loss of serviceability is acceptable.

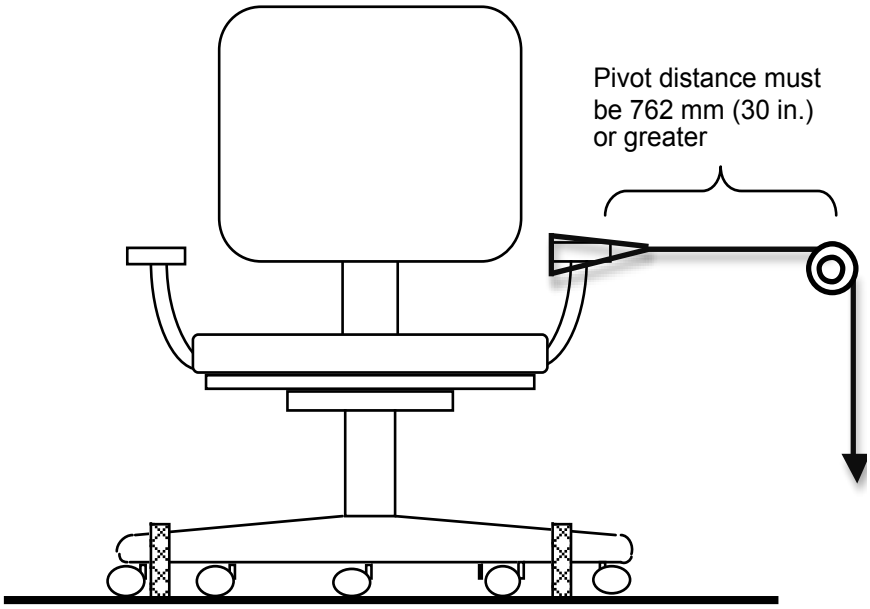



**Figure 13 - Arm Strength Test - Horizontal - Static**

## 13 Arm Strength Test - Horizontal - Static (See Figure 13)

### 13.1 Applicability

This test applies to all chairs with arms.

### 13.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chair to withstand stresses caused by applying outward forces to the arm(s).

### 13.3 Test Setup

a) The chair shall be placed on a test platform. Restrain the chair from horizontal movement and tipping including rotational movement of the seat. Blocking movement of the chair shall not provide a counterbalancing force that aids the support structure of the armrest under load and/or chair control/tilt mechanism. The restraints shall not restrict the chair arm movement. Figure 13 shows one acceptable method of restraining the chair. For four-leg chairs, restraining across the seat is acceptable (see Figure 12a).
b) If adjustable features are available, all adjustments shall be set at normal use conditions.
c) A loading device or strap, not greater than 25 mm (1 in.) in horizontal width, shall be attached to the arm so that the load is initially applied horizontally to the armrest structure at the apparent weakest point. For armrests that pivot in the horizontal plane, apply the load at the pivot point.
d) Apply an initially horizontal pull force to the load adapter using a mechanism such as a cable and pulley or other mechanism having a pivot point 762 mm (30 in.) or greater from the arm. The mechanism must allow the arm to deflect as a result of the load application.

### 13.4 Test Procedures

#### 13.4.1 Functional Load

a) A force of 445 N (100 lbf.) shall be applied for one (1) minute in the outward direction.
b) Remove the force.

#### 13.4.2 Proof Load

a) A force of 667 N (150 lbf.) shall be applied for 15 seconds in the outward direction.
b) Remove the force.

### 13.5 Acceptance Level

#### 13.5.1 Functional Load

A functional load applied once shall cause no loss of serviceability.

#### 13.5.2 Proof Load

A proof load applied once shall cause no sudden and major change in the structural integrity of the unit. Loss of serviceability is acceptable.

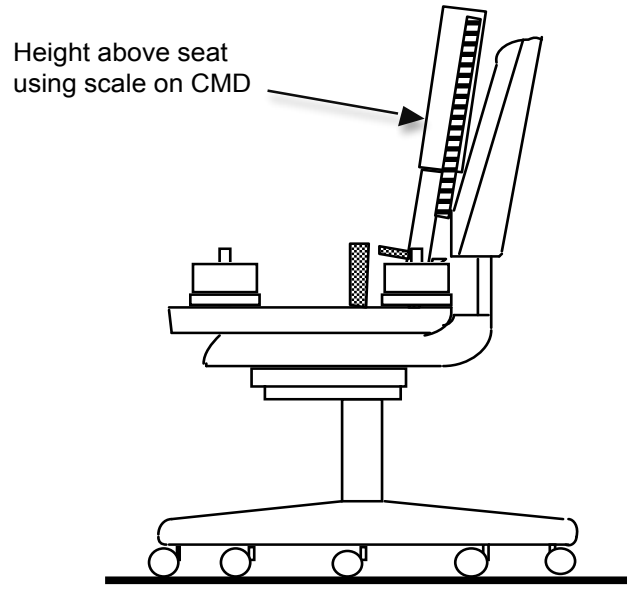



**Figure 14a - Test Height Determination
Backrest Durability Test Cyclic - Type I**

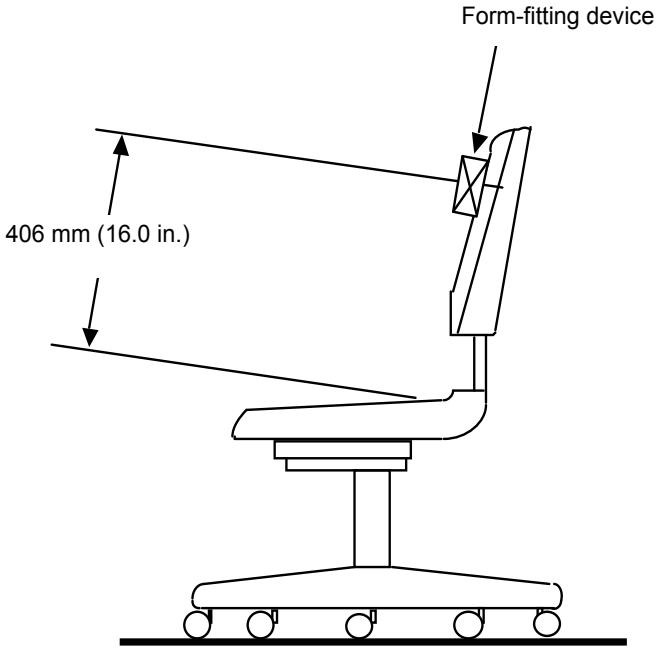



**Figure 14b - Positioning of Form-Fitting Device for Backrests Higher than 452 mm (17.8 in.) Backrest Durability Test Cyclic - Type I**

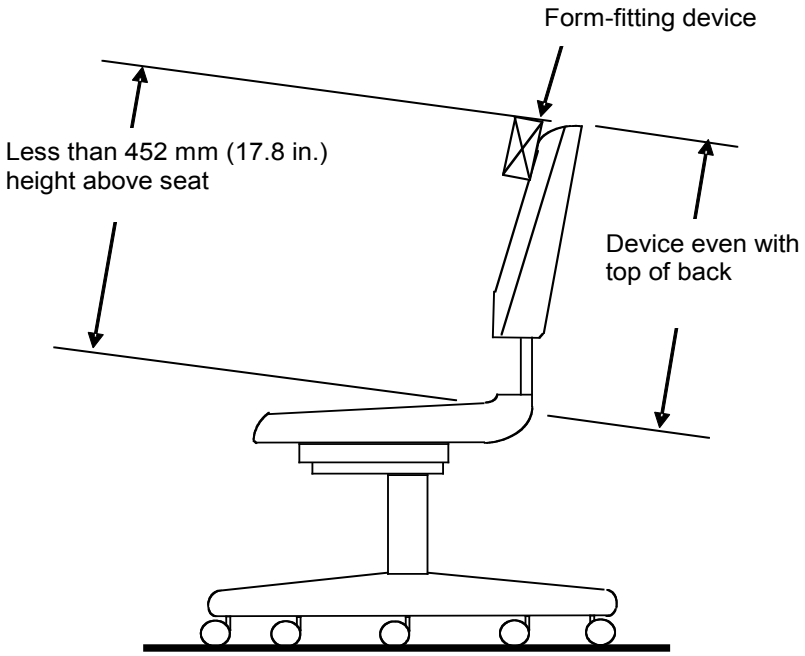



**Figure 14c - Positioning of Form-Fitting Device for Backrests Lower than 452 mm (17.8 in.) Backrest Durability Test Cyclic - Type I**

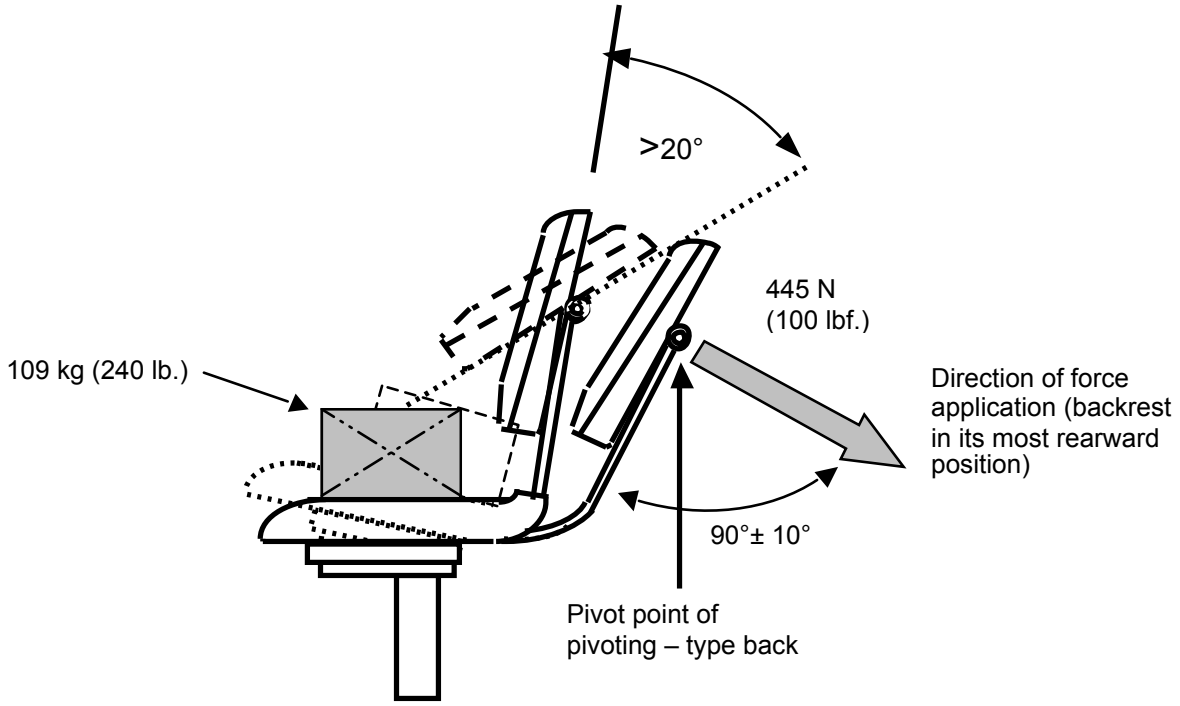



**Figure 14d - Force Application for Backrests that Pivot Greater than 20° Backrest Durability Test - Cyclic - Type I**

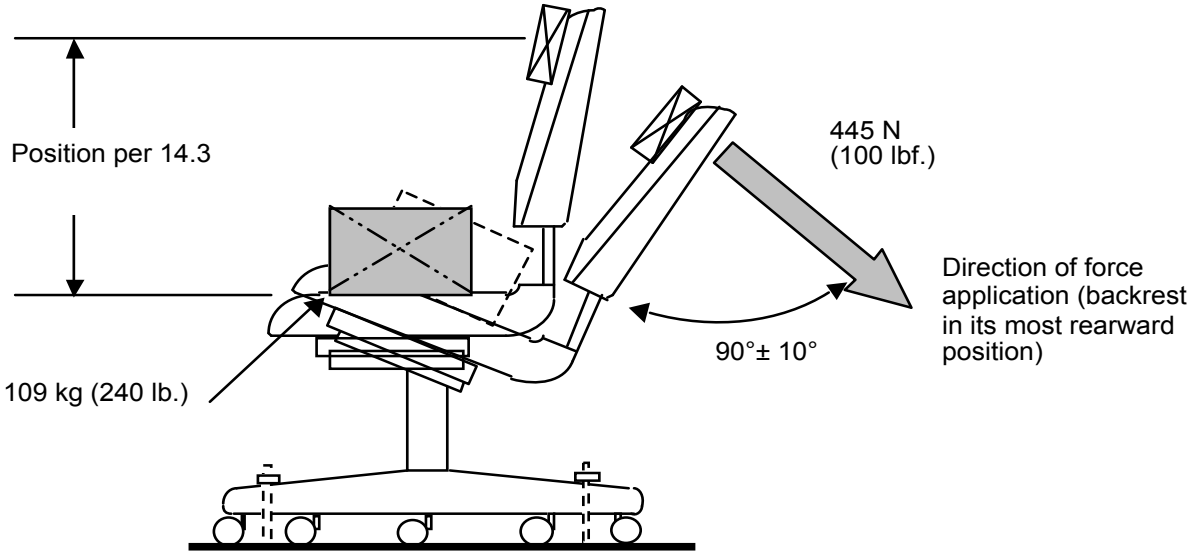



**Figure 14e - Force Application for All Other Backrests**
**Backrest Durability Test – Cyclic – Type I**

## 14 Backrest Durability Test - Cyclic - Type I (See Figures 14a through 14e)

### 14.1 Applicability

This test shall be performed on Type I Tilting chairs with backrests greater than 200 mm (7.9 in.) in height.

### 14.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chairs to withstand fatigue stresses and wear caused by rearward force on the backrest of the chair.

### 14.3 Test Setup

**14.3.1** The chair shall be placed on a test platform in an upright position with the base/legs restrained from movement. If pushing on the backrest with the test device, the chair must be restricted from rotating. Clamping shall be done so as not to restrict the movement of the backrest(s) or arm(s) of the chair.

**14.3.2** If adjustable features are available, all adjustments shall be set at normal use conditions.

**Note:** For chairs with tilt mechanisms that lock, locking the mechanism changes the classification of the chair. (See Section 4). Chairs with tilt mechanisms in an unlocked position shall be tested according to this section and an additional test shall be performed according to Section 15. When testing in accordance with Section 15, the chair shall be tested in the upright locked position.

**14.3.3** Determine points 406 mm (16 in.) and 452 mm (17.8 in.) above the seat (See Section 3.5). Mark these points on the vertical centerline of the backrest.

a) If the top of the load-bearing structure/surface of the backrest is greater than or equal to 452 mm (17.8 in.) above the seat, position the center of the form-fitting device (See Definition 2.10) 406 mm (16 in.) above the seat. (See Figure 14b).

b) If the top of the load-bearing structure/surface of the backrest is less than 452 mm (17.8 in.) above the seat, position the top of the form-fitting device even with the top of the load-bearing structure/surface. (See Figure 14c).

c) If the unit has a pivoting backrest that stops at a position less than or equal to 20 degrees rearward (See Figure 14d), position the form-fitting device as directed in a) or b). If the unit has a pivoting backrest that stops at a position greater than 20 degrees rearward of the backrest, position the center of the form-fitting device at the height of the pivoting point. (See Figure 14d).

**14.3.4** Attach a loading device (front push or back pull) to the horizontal center of the backrest as determined above. With the backrest at its back stop position, apply a force that is initially 90 degrees ± 10 degrees to the plane of the backrest. The force is not intended to be maintained at 90 degrees ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley. The angle of the backrest plane may be determined by the angle of the plane of the front of the CMD upright. (See Figure 14a).

**Note:** Where the design of the chair does not allow the transfer of force(s) from the form-fitting device to the load-bearing structure/surface, then a bridging device 38 mm to 102 mm (1.5 in. to 4 in.) in height may be used to span the width of the load-bearing structure/surface.

**14.3.5** A weight of 109 kg (240 lbs.) shall remain in the center of the seat and be secured if necessary. (See Figure 14d and 14e).

**14.3.6** The loading device shall be adjusted to apply a 445 N (100 lbf.) force to the backrest. (See Figure 14e).

**14.3.7** The loading device shall be set at a rate between 10 and 30 cycles per minute.

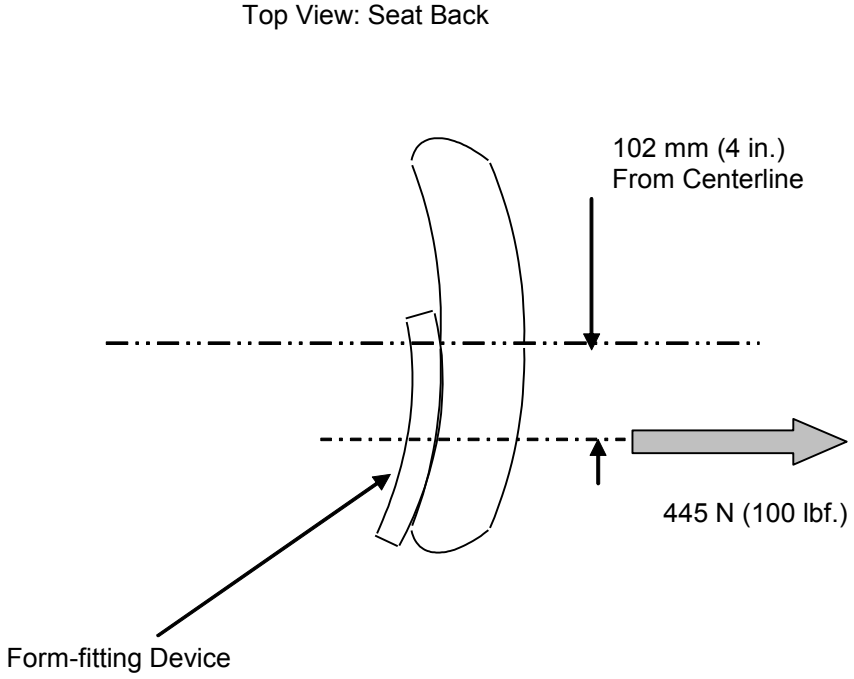



**Figure 14f - Off-center Backrest Durability Loading - Left**

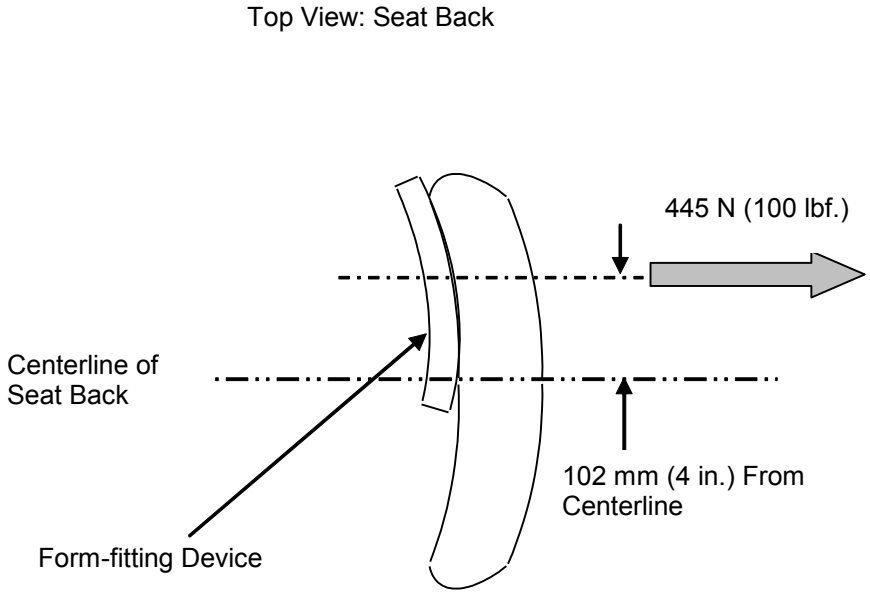



**Figure 14g - Off-center Backrest Durability Loading - Right**

### 14.4 Test Procedures

**14.4.1** For chairs with backrest widths less than or equal to 406 mm (16 in.) at the height of the loading point, apply the load to the backrest for 120,000 cycles.

**14.4.2** For chairs with backrest widths greater than 406 mm (16 in.) at the height of the loading point, apply the load to the backrest for 80,000 cycles.

a) Keeping the load at the height determined above, reposition the load 102 mm (4 in.) to the right of the vertical centerline. The load shall be applied through a form-fitting device or bridging device if appropriate – see Note in 14.3.4. (See Figure 14f and 14g). With the backrest at its back stop position, apply a force that is initially 90 degrees ± 10 degrees to the plane of the backrest. The force is not intended to be maintained at 90 degrees ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley. Apply this load for 20,000 cycles.

b) Keeping the load at the height determined above, reposition the load 102 mm (4 in.) to the left of the vertical centerline. The load shall be applied through a form-fitting device or bridging device if appropriate – see Note in 14.3.4. (See Figure 14f and 14g). With the backrest at its back stop position, apply a force that is initially 90 degrees ± 10 degrees to the plane of the backrest. The force is not intended to be maintained at 90 degrees ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley. Apply this load for 20,000 cycles.

### 14.5 Acceptance Level

There shall be no loss of serviceability.

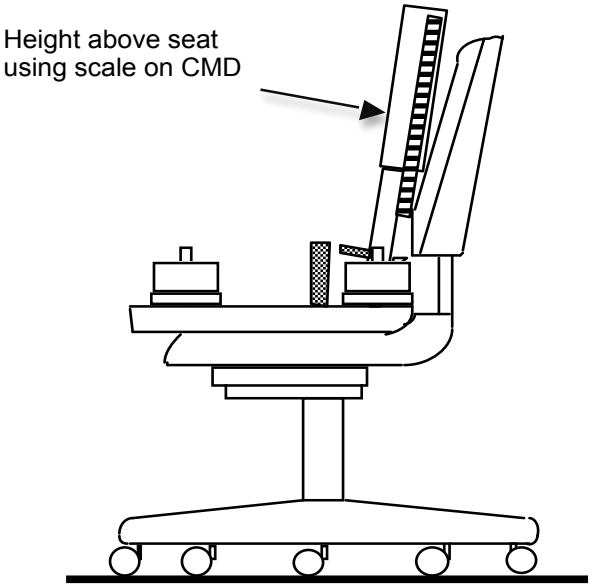



**Figure 15a - Test Height Determination**
**Backrest Durability Test - Cyclic - Type II and III**

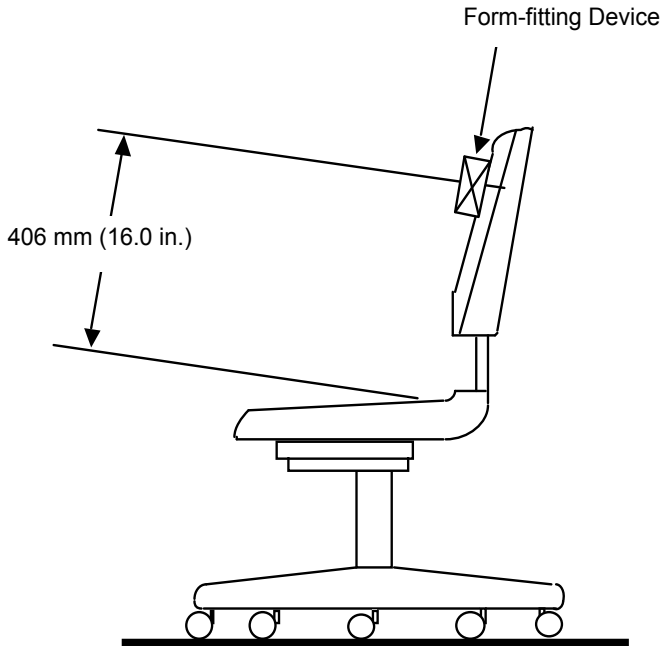



**Figure 15b - Positioning of Form-Fitting Device for Backrests Higher than 452 mm (17.8 in.) Backrest Durability Test – Cyclic - Type II and III**

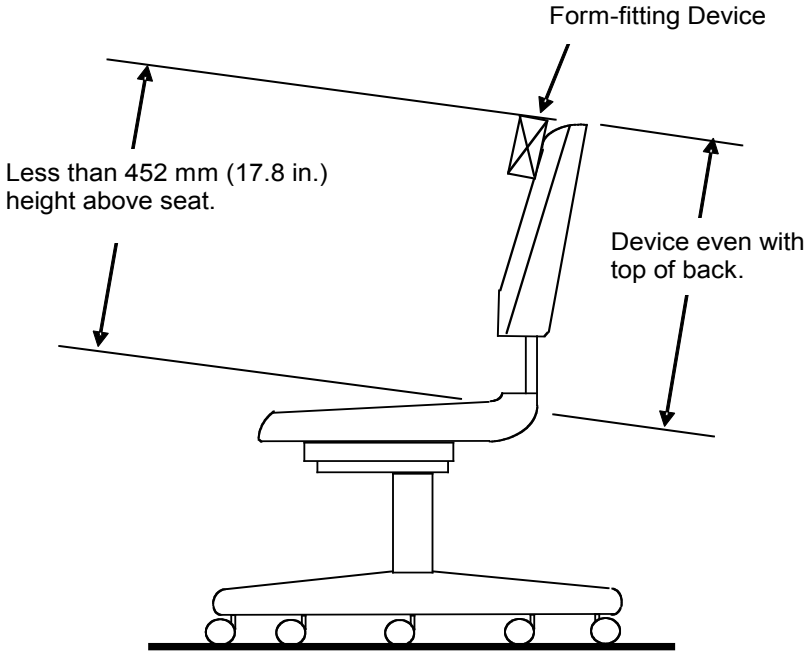



**Figure 15c - Positioning of Form-Fitting Device for Backrests Lower than 452 mm (17.8 in.) Backrest Durability Test – Cyclic - Type II and III**

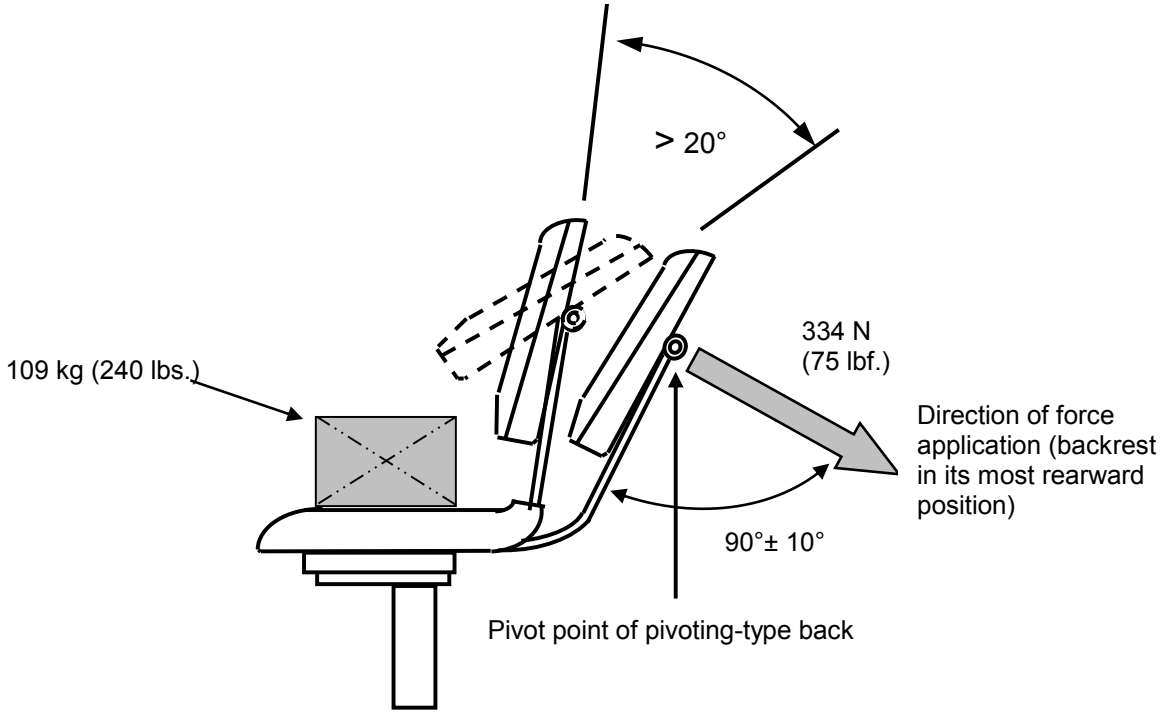



**Figure 15d - Force Application for Backrests that Pivot Greater than 20 Degrees**
**Backrest Durability Test - Cyclic - Type II and III**

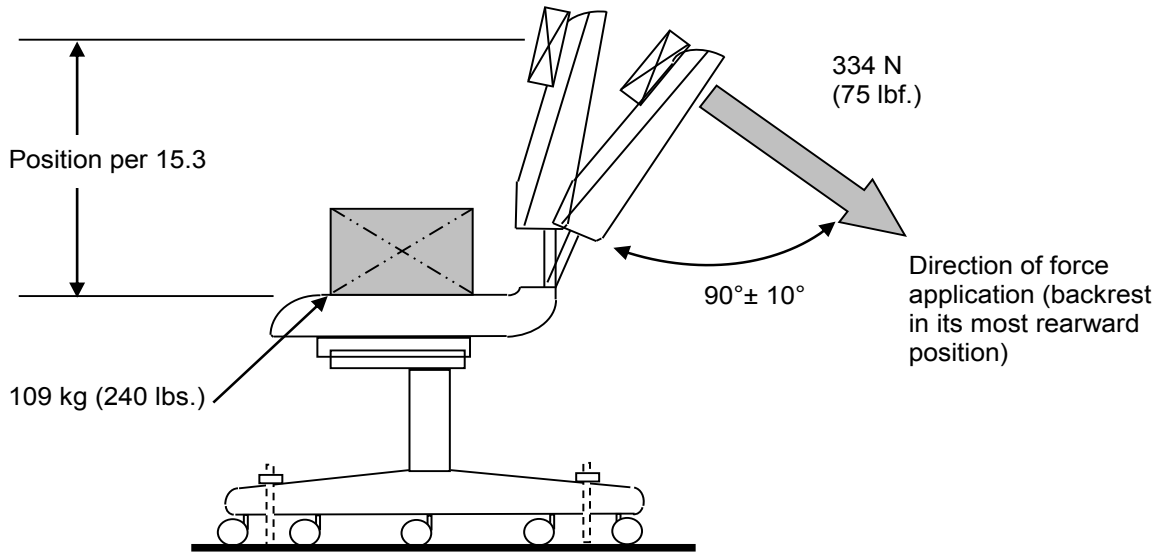



**Figure 15e - Force Application for All Other Backrests**
**Backrest Durability Test - Cyclic - Type II and III**

## 15 Backrest Durability Test - Cyclic - Type II and III (See Figures 15a through 15g)

### 15.1 Applicability

This test shall be performed on Type II and lll chairs.

**Note:** This test does not apply to chairs with backrest height less than 200 mm (7.9 in.).

### 15.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chairs to withstand fatigue stresses and wear caused by rearward force on the backrest of the chair.

### 15.3 Test Setup

**15.3.1** The chair shall be placed on a test platform in an upright position with the base/legs restrained from movement. If pushing on the backrest with the test device, the chair must be restricted from rotating. Clamping shall be done so as not to restrict the movement of the backrest(s) or arm(s) of the chair.

**15.3.2** If adjustable features are available, all adjustments shall be set at normal use conditions. **Note:** For chairs with tilt mechanisms that lock, locking the mechanism changes the classification of the chair. (See Section 4). Chairs with tilt mechanisms in an unlocked position shall be tested according to Section 14 and an additional test shall be performed according to Section 15. When testing in accordance with Section 15, the chair shall be tested in the upright locked position.

**15.3.3** Determine points 406 mm (16 in.) and 452 mm (17.8 in.) above the seat (See Section 3.5). Mark these points on the vertical centerline of the backrest.

a) If the top of the load-bearing structure/surface of the backrest is greater than or equal to 452 mm (17.8 in.) above the seat, position the center of the form-fitting device (See Definition 2.9) 406 mm (16 in.) above the seat. (See Figure 15b).

b) If the top of the load-bearing structure/surface of the backrest is less than 452 mm (17.8 in.) above the seat, position the top of the form-fitting device even with the top of the load-bearing structure/surface. (See Figure 15c).

c) If the unit has a pivoting backrest that stops at a position less than or equal to 20 degrees rearward (See Figure 15d), position the form-fitting device as directed in a) or b). If the unit has a pivoting backrest that stops at a position greater than 20 degrees rearward of the backrest, position the center of the form-fitting device at the height of the pivoting point. (See Figure 15d).

**15.3.4** Attach a loading device (front push or back pull) to the horizontal center of the backrest as determined above. With the backrest at its back stop position, apply a force that is initially 90 degrees ± 10 degrees to the plane of the backrest. The force is not intended to be maintained at 90 ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley. The angle of the backrest plane may be determined by the angle of the plane of the front of the CMD upright. (See Figure 15a).

**Note:** Where the design of the chair does not allow the transfer of force(s) from the form-fitting device to the load-bearing structure/surface, then a bridging device 38 mm to 102 mm (1.5 in. to 4 in.) in height may be used to span the width of the load-bearing structure/surface.

**15.3.5** A weight of 109 kg (240 lbs.) shall remain in the center of the seat and be secured if necessary. (See Figure 15d and 15e).

**15.3.6** The loading device shall be adjusted to apply a 334 N (75 lbf.) total force to the backrest. If the backrest/tilt lock mechanism will not accept the load due to gradual slipping of the adjustment mechanism during the load application, set the backrest to its most rearward (stopped) position, then apply the specified load(s).

**15.3.7** The loading device shall be set at a rate between 10 and 30 cycles per minute.

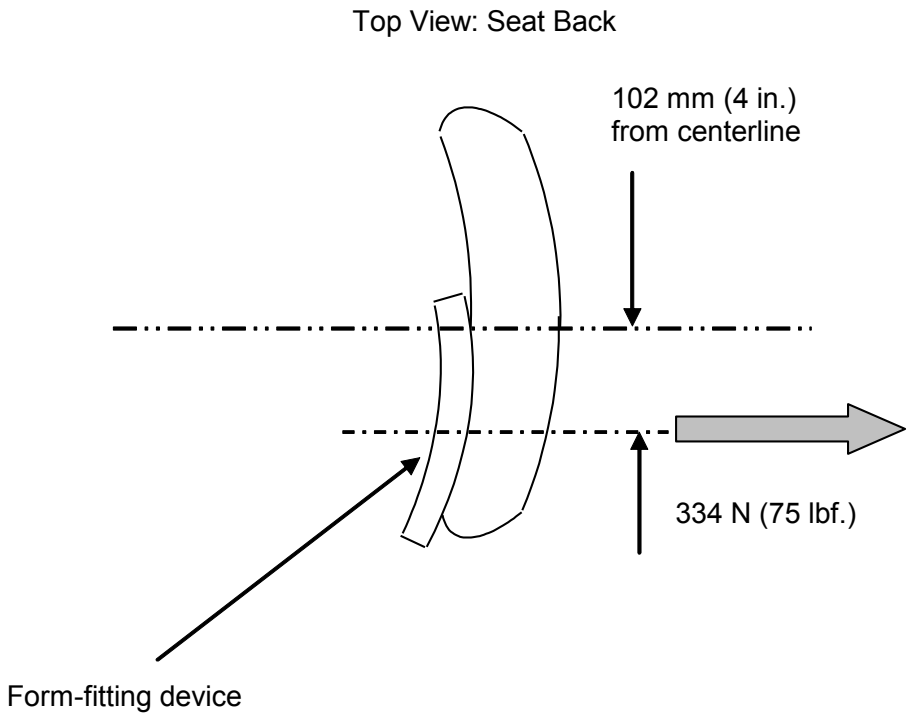



**Figure 15f - Off-center Backrest Durability Loading – Cyclic – Type II and III - Left**

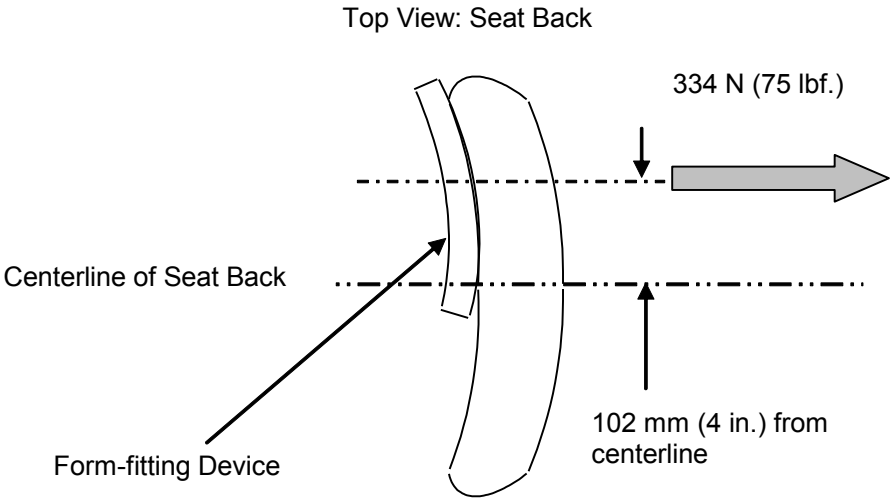



**Figure 15g - Off-center Backrest Durability Loading – Cyclic – Type II and III - Right**

### 15.4 Test Procedures

**15.4.1** For chairs with backrest widths less than or equal to 406 mm (16 in.) at the height of the loading point, apply the load to the backrest for 120,000 cycles.

**15.4.2** For chairs with backrest widths greater than 406 mm (16 in.) at the height of the loading point, apply the load to the backrest for 80,000 cycles.

a) Keeping the load at the height determined above, reposition the load 102 mm (4 in.) to the right of the vertical centerline (See Figure 15f and 15g). With the backrest at its back stop position, apply a force that is initially 90 degrees ± 10 degrees to the plane of the backrest. The force is not intended to be maintained at 90 degrees ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley. Apply this load for 20,000 cycles.

b) Keeping the load at the height determined above, reposition the load 102 mm (4 in.) to the left of the vertical centerline (See Figure 15f and 15g). With the backrest at its back stop position, apply a force that is initially 90 degrees ± 10 degrees to the plane of the backrest. The force is not intended to be maintained at 90 degrees ± 10 degrees throughout the loading of the backrest. If applying the load with a cable and pulley system, the cable must initially be a minimum of 762 mm (30 in.) in length from the attachment point to the pulley. Apply this load for 20,000 cycles.

### 15.5 Acceptance Level

There shall be no loss of serviceability.

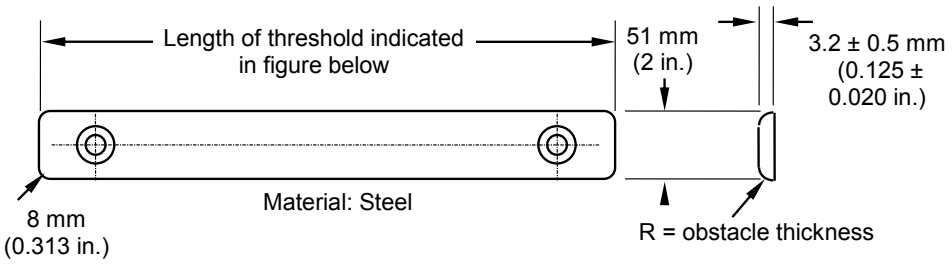



**Figure 16a - Obstacle Detail** Typical All Sides

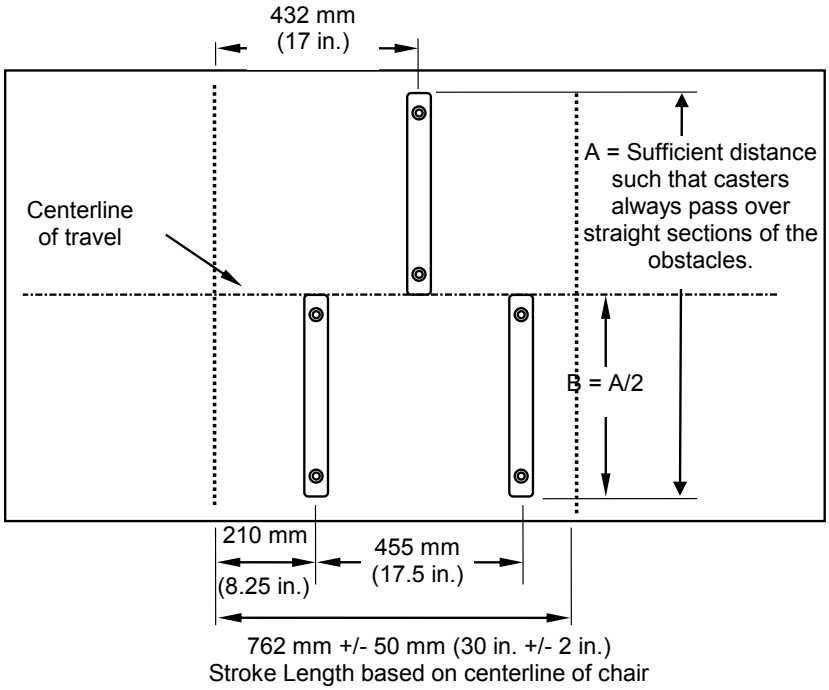



**Figure 16b - Obstacle Layout for Pedestal Base Chairs**

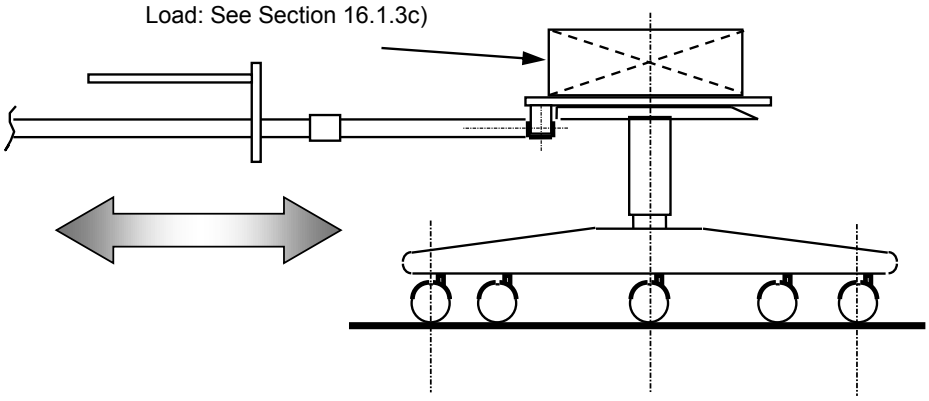



**Figure 16c - Machine Schematic for Pedestal Base Chairs**

**Figures 16a through 16c - Caster/Chair Base Durability Test — Cyclic**

## 16 Caster/Chair Base Durability Test - Cyclic (See Figures 16a through 16e)

### 16.1 Caster/Chair Base Durability Test for Pedestal Base Chairs

#### 16.1.1 Applicability

This test applies to pedestal base chairs with casters.

#### 16.1.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chair base and casters to withstand fatigue stresses and wear caused by moving the chair back and forth.

#### 16.1.3 Test Setup

a) The chair, or chair base with casters, shall be attached to a cycling device similar to Figure 16c. When testing a full chair, set all adjustments to midpoint.
b) The chair shall be cycled on a smooth hard surface (steel preferred) with three obstacles as shown in Figure 16a in accordance with the obstacle layout as shown in Figure 16b.
c) If a complete chair is to be tested, place a 122 kg (270 lb.) load on the seat of the chair. If a fixture is used, the weight of the test assembly (base assembly, fixture and weights) shall be equivalent to 122 kg (270 lb.) plus the weight of the chair in its fully assembled configuration. (See Figure 16c). The base and casters shall be free to rotate and swivel.
d) The stroke of the cycling device shall be adjusted to 762 +/- 50 mm (30 +/- 2 in.) of travel. The stroke shall be oriented so the casters roll across the test platform and obstacles as shown in Figure 16b.
e) The cycling device shall be operated at a rate of 10 ± 2 cycles per minute. One cycle shall consist of a forward and backward stroke of the cycling device.

#### 16.1.4 Test Procedure

a) The chair or chair base shall be cycled 2,000 cycles over the obstacles as shown in Figure 16b and then 98,000 cycles on a smooth, hard surface (steel preferred) without obstacles.
b) At the conclusion of cycling, a 22 N (5 lbf.) pull force shall be applied to each caster in line with the caster stem centerline.

#### 16.1.5 Acceptance Level

There shall be no loss of serviceability. No part of the caster shall separate from the chair as a result of the application of the 22 N (5 lbf.) force.

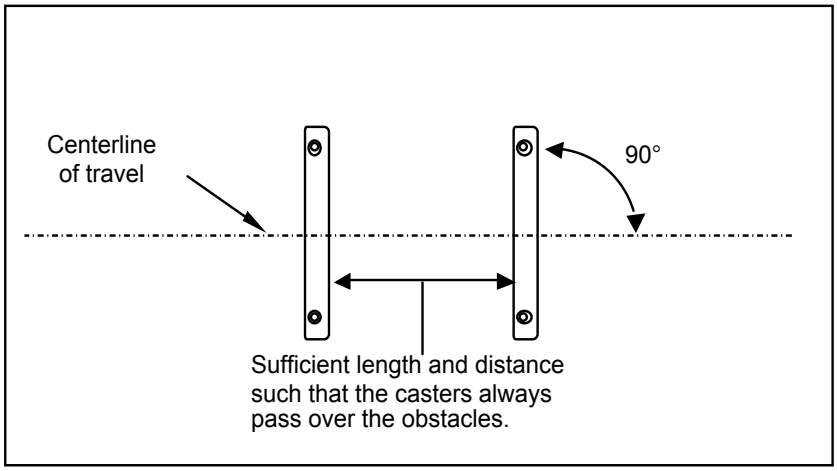



**Figure 16d - Obstacle Layout for Chairs with Legs**

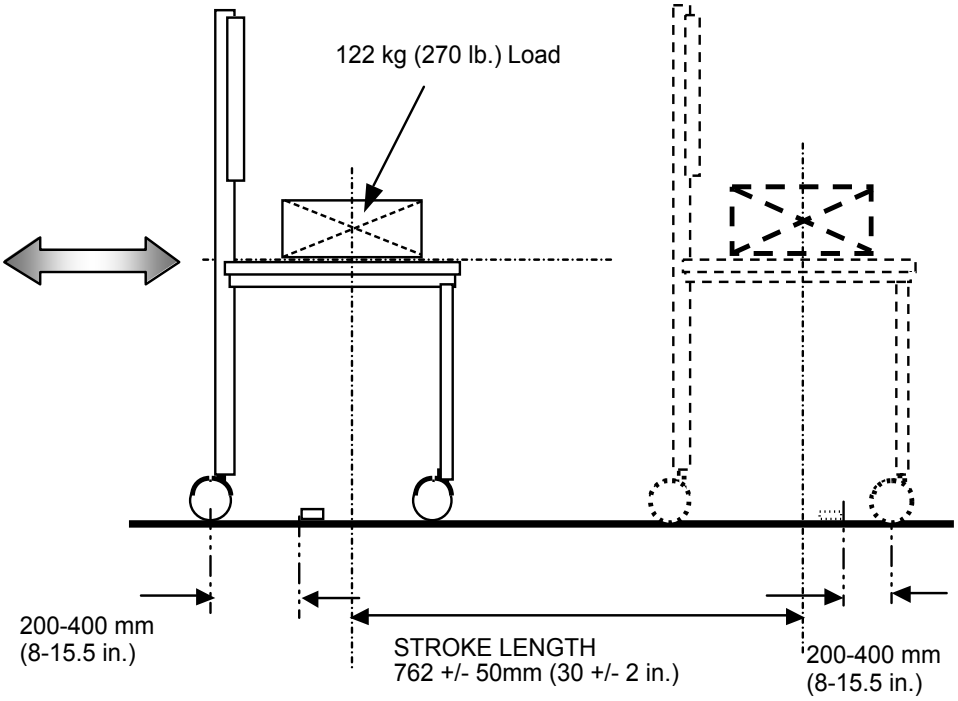



**Figure 16e – Machine Schematic for Chairs with Legs**

**Figure 16d & 16e Caster/Chair Base Durability Test - Cyclic Obstacle Layout and Machine Stroke**

## 16.2 Caster/Chair Frame Durability Test for Non-pedestal Chairs with Casters

### 16.2.1 Applicability

This test applies to chairs with legs and casters.

### 16.2.2 Purpose of Test

The purpose of this test is to evaluate the ability of the chair frame and casters to withstand fatigue stresses and wear caused by moving the chair back and forth.

### 16.2.3 Test Setup

a) The chair, or chair frame with casters, shall be attached to a cycling device similar to Figure 16e. The cycling device shall be attached to apply the horizontal motion at the highest point that does not cause the chair to tip or lift the casters entirely off the platform during the test but not any higher than 25 mm (1 in.) above the bottom of the applied weight.

b) The chair shall be cycled on a smooth hard surface (steel preferred) with two obstacle layout as shown in Figure 16d and 16e in accordance with the obstacle detail as shown in Figure 16a.

c) Place and secure a distributed 122 kg (270 lb.) on the center of seat of the chair or chair base. The casters shall be free to rotate and swivel.

**Note:** Some chairs of this type have fixed rear casters. If that is the case, the casters should roll freely.

d) The stroke of the cycling device shall be adjusted to 762 +/- 50 mm (30 +/- 2 in.) of travel. The stroke shall be set and the obstacles shall be oriented such that the casters roll across the test platform and obstacles, and that each caster travels beyond the obstacle by 200 to 400 mm (8 to 15.5 in.) in each direction as shown in Figure 16e. During one cycle, each caster shall cross a threshold twice (once in the forward direction and once in the return direction); the obstacles shall be spaced such that the leading and following sets of casters do not cross the thresholds simultaneously.

e) The cycling device shall be operated at a rate of 10 ± 2 cycles per minute. One cycle shall consist of a forward and backward stroke of the cycling device.

f) For units with caster and glide combinations, the legs without casters may be raised a maximum of 51 mm (2 in.) above the test platform (supported by the attachment device) during this test. The casters shall be free to rotate and swivel where applicable. There shall be no load placed on the seat of the unit or unit base.

### 16.2.4 Test Procedure

a) The chair or chair base shall be cycled for 2,000 cycles over the obstacles as shown in Figures 16d and 16e and then 98,000 cycles on a smooth hard surface (steel preferred) without obstacles.

b) At the conclusion of cycling, a 22 N (5 lbf.) pull force shall be applied to each caster in line with the caster stem centerline.

### 16.2.5 Acceptance Level

There shall be no loss of serviceability. No part of the caster shall separate from the chair as a result of the application of the 22 N (5 lbf.) force.

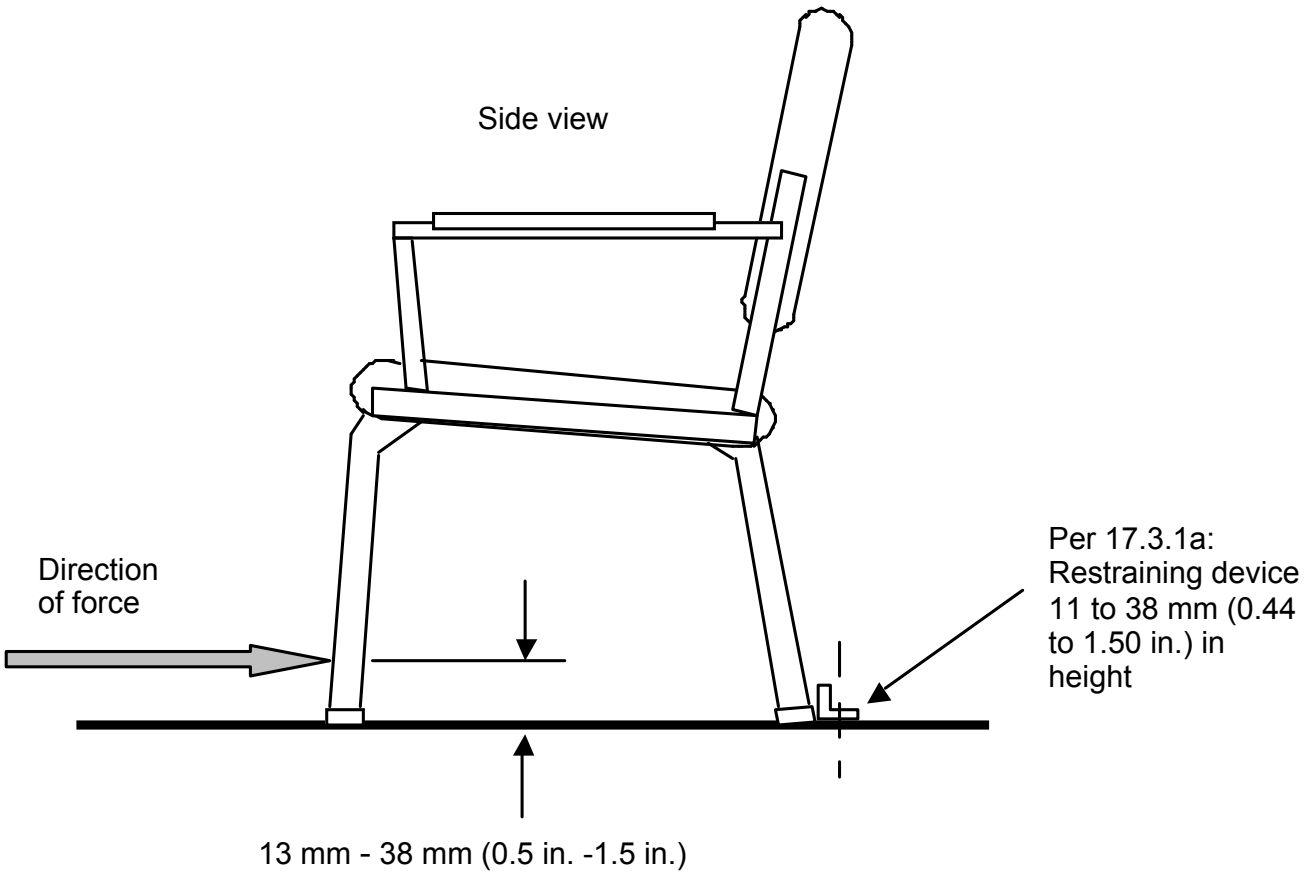



**Figure 17a - Leg Strength Test - Front Application**

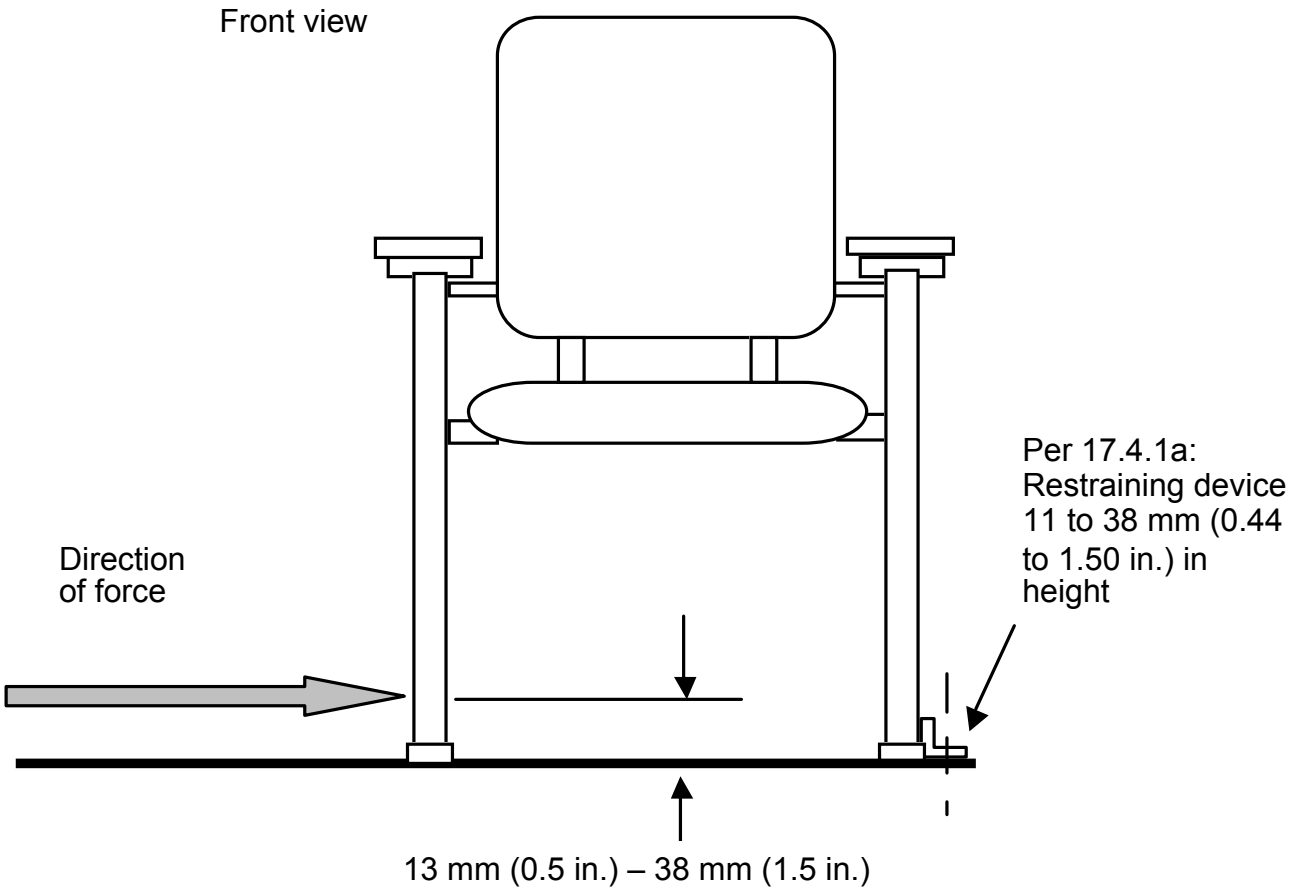



**Figure 17b - Leg Strength Test - Side Application**

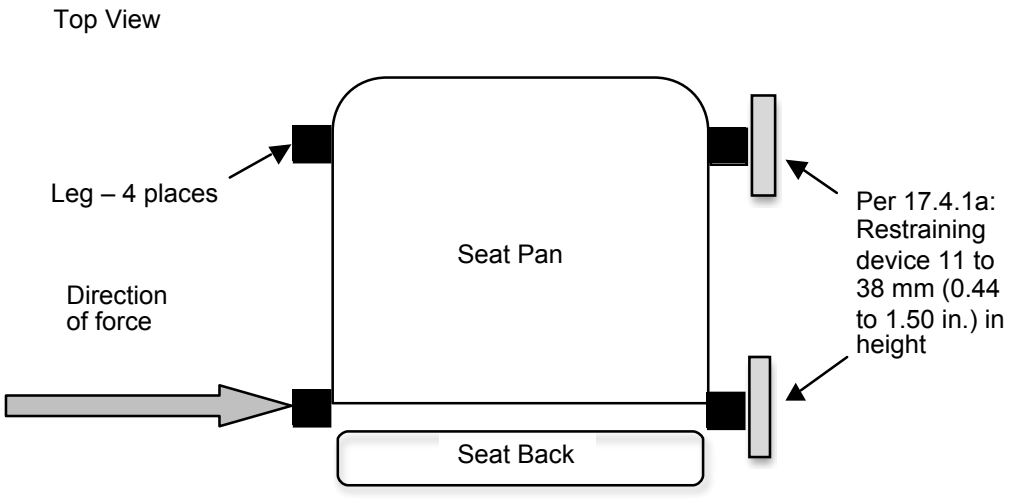



**Figure 17c – Leg Strength Test – Side Application**

## 17 Leg Strength Test - Front and Side Application (See Figures 17a – 17c)

### 17.1 Applicability

This test applies to all chairs with legs, including leg bases. See definitions 2.17 and 2.25.

### 17.2 Purpose of Test

The purpose of this test is to evaluate the ability of legs to withstand horizontal forces.

### 17.3 Front Load Test

#### 17.3.1 Test Setup

a) The chair shall be placed on a test platform, with the back legs restrained by a block 11 to 38 mm (.44 to 1.50 in.) high. Figure 17a shows one acceptable method of restraining the chair.

b) If adjustable features are available, all adjustments shall be set at normal use conditions.

c) The loading device shall be attached to the chair so that an initially horizontal force is applied inward and parallel to the front-to-rear axis of the chair, between 13 mm (0.5 in.)

and 38 mm (1.5 in.) from the bottom of a leg as shown in Figure 17a. For chairs with casters, apply the load to the chair leg, but not more than 13 mm (0.5 in.) from the point of caster attachment (bottom of the leg). The load shall be applied to the apparent weakest point of the leg. Where the apparent weakest point is the left or right edge of the leg, apply the load so that it is no greater than 25 mm (1.0 in.) from the edge.

### 17.3.2 Test Procedures

#### 17.3.2.1 Functional Load Test

a) A force of 334 N (75 lbf.) shall be applied once to each front leg individually for one (1) minute.
b) Remove the force.

#### 17.3.2.2 Proof Load Test

a) A force of 503 N (113 lbf.) shall be applied once to each front leg individually for one (1) minute.
b) Remove the force.

## 17.4 Side Load Tests

**Note:** A separate chair may be used for the side load portion of the test.

**Note:** Informative Appendix H offers a test for Simultaneous Side Leg strength. It is acceptable to perform the test in Appendix H in lieu of 17.4.2.1. The Proof Load shall be conducted on the product regardless of testing to 17.4.2.1 or Appendix H.

### 17.4.1 Test Setup

a) The chair shall be placed on a test platform with the side leg(s) restrained by a block 11 to 38 mm (.44 to 1.50 in.) high. Figure 17b shows one acceptable method of restraining the chair.
b) If adjustable features are available, all adjustments shall be set at normal use conditions.
c) The loading device shall be attached to the chair so that an initially horizontal force is applied inward and parallel to the side-to-side axis of the chair, between 13 mm (0.5 in.) and 38 mm (1.5 in.) from the bottom of a leg as shown in Figure 17b. For chairs with casters, apply the load to the chair leg, but not more than 13 mm (0.5 in.) from the point of caster attachment (bottom of the leg). The load shall be applied to the apparent weakest point (front-to-back) of the leg. Where the apparent weakest point is the front or rear edge of the leg, apply the load so that it is no greater than 25 mm (1.0 in.) from the edge.

#### 17.4.2 Test Procedure

##### 17.4.2.1 Functional Load Test

a) A force of 334 N (75 lbf.) shall be applied once to a front and rear leg individually for one (1) minute.
b) Remove the force.

##### 17.4.2.2 Proof Load Test

a) A force of 503 N (113 lbf.) shall be applied once to a front and rear leg individually for one (1) minute.
b) Remove the force.

### 17.5 Acceptance Level - Front and Side Load Tests

#### 17.5.1 Functional Load

Functional load(s) shall cause no loss of serviceability.

#### 17.5.2 Proof Load

Proof load(s) shall cause no sudden and major change in the structural integrity of the chair. Loss of serviceability is acceptable.

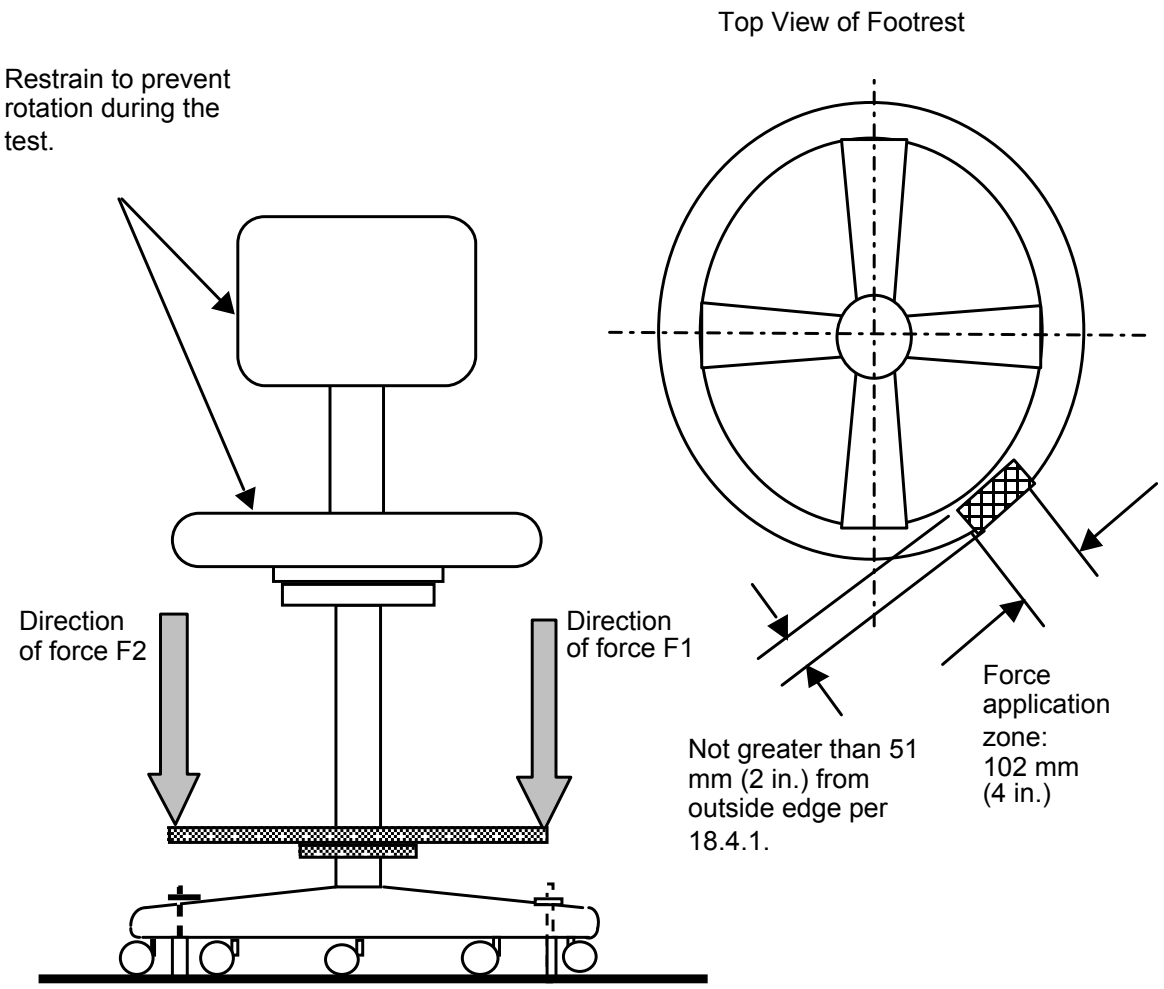



**Figure 18 - Footrest Static Load Test - Vertical**

## 18 Footrest Static Load Test - Vertical (See Figure 18)

### 18.1 Applicability

The footrest static load test shall be performed on all chairs with a footrest feature and a seat height equal to or greater than (or can be adjusted to) 610 mm (24 in.).

### 18.2 Purpose of Test

The purpose of this test is to evaluate the ability of the footrest to withstand static loading stresses.

### 18.3 Functional Load Test

#### 18.3.1 Test Set Up

a) The chair shall be placed on a test platform and restrained as shown in Figure 18.

b) On chairs with adjustable features, all adjustments shall be set at normal use position. The seat and upper structure shall be restrained as necessary to prevent rotation during the test. Chair cushions and/or other components not related to the structure of the footrest may be removed to facilitate load application.

**Note:** This test is not intended to evaluate the performance of casters or glides. Casters may be removed, left in place or replaced by spacers to provide clearance if necessary.

### 18.4 Test Procedures

#### 18.4.1 Static Load Test – Functional Load

a) Apply a force F1 of 445 N (100 lbf.) uniformly along a 102 mm (4 in.) distance along the footrest but not greater than 51 mm (2 in.) from the outside edge at the apparent weakest point of the structure for one (1) minute in the vertical downward direction. (See Figure 18: Top View of Footrest). If the footrest adjusts in height relative to the seat and allows for a force application 180 degrees (on the opposite side of the chair) from the primary force application, maintain force F1 and apply an additional force F2 of 445 N (100 lbf.) to the footrest at the opposing position for an additional one (1) minute. The F2 force shall also be applied uniformly along a 102 mm (4 in.) distance along the footrest but not greater than 51 mm (2 in.) from the outside edge.

b) If applicable, remove force F2.

c) Increase the force F1 to 200 lbf. for one (1) minute.

#### 18.4.2 Acceptance level

There shall be no loss of serviceability or sudden loss of footrest height.

#### 18.4.3 Static Load Test – Proof Load

Apply a force of 1334 N (300 lbf.) uniformly along a 102 mm (4 in.) distance along the footrest but not greater than 51 mm (2 in.) from the outside edge at the apparent weakest point of the structure for one (1) minute in the vertical downward direction.

### 18.5 Acceptance level

The load applied once shall cause no sudden and major change in the structural integrity of the unit. Loss of serviceability is acceptable.

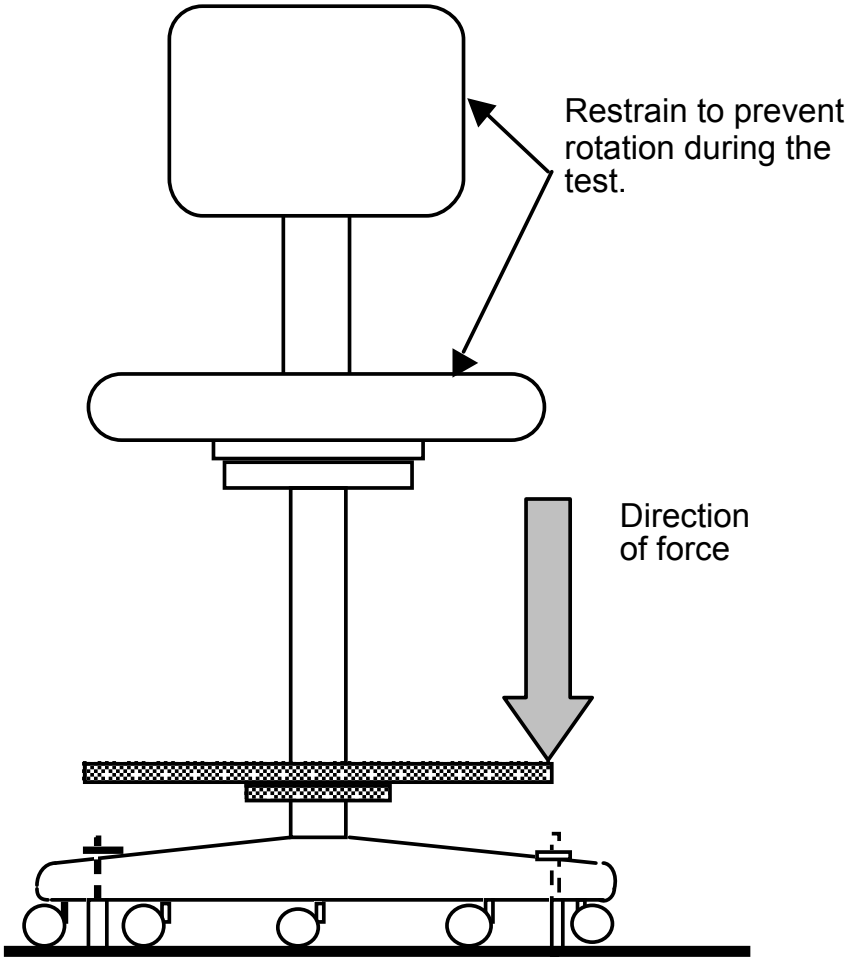



**Figure 19 - Footrest Durability Test - Vertical - Cyclic**

## 19 Footrest Durability Test - Vertical - Cyclic (See Figure 19)

### 19.1 Applicability

The footrest durability test shall be performed on all chairs with a footrest feature and a seat height equal to or greater than (or can be adjusted to) 610 mm (24 in.).

### 19.2 Purpose of Test

The purpose of this test is to evaluate the ability of the footrest to withstand stresses that occur as a result of repetitive loading.

### 19.3 Test Set Up

a) The chair shall be placed on a test platform and restrained as shown in Figure 19.

b) On chairs with adjustable features, all adjustments shall be set at normal use position. The seat and upper structure shall be restrained as necessary to prevent rotation during the test. Chair cushions and/or other components not related to the structure of the footrest may be removed to facilitate load application.

**Note:** This test is not intended to evaluate the performance of casters or glides. Casters may be removed, left in place or replaced by spacers to provide clearance if necessary.

### 19.4 Test Procedure

a) A 890 N (200-lbf.) force shall be applied uniformly along a 102 mm (4 in.) distance along the footrest but not greater than 51 mm (2 in.) from the outside edge at the apparent weakest point of the structure. (See Figure 18: Top View of Footrest). When the weakest position is not obvious, several load application positions may be necessary to properly test the product. If the footrest moves more than 25 mm (1 in.) within the first 500 cycles, discontinue testing (See 19.5 Acceptance level). If the footrest moves throughout the remainder of the test, reset it to its original position when it is within 12 mm (0.5 in.) from its lowest position.

b) The force shall be applied and removed 50,000 cycles at a rate between 10 and 30 cycles per minute.

### 19.5 Acceptance level

There shall be no loss of serviceability. Adjustable footrests that move more than 25 mm (1 in.) in the first 500 cycles shall be considered to have lost their serviceability.

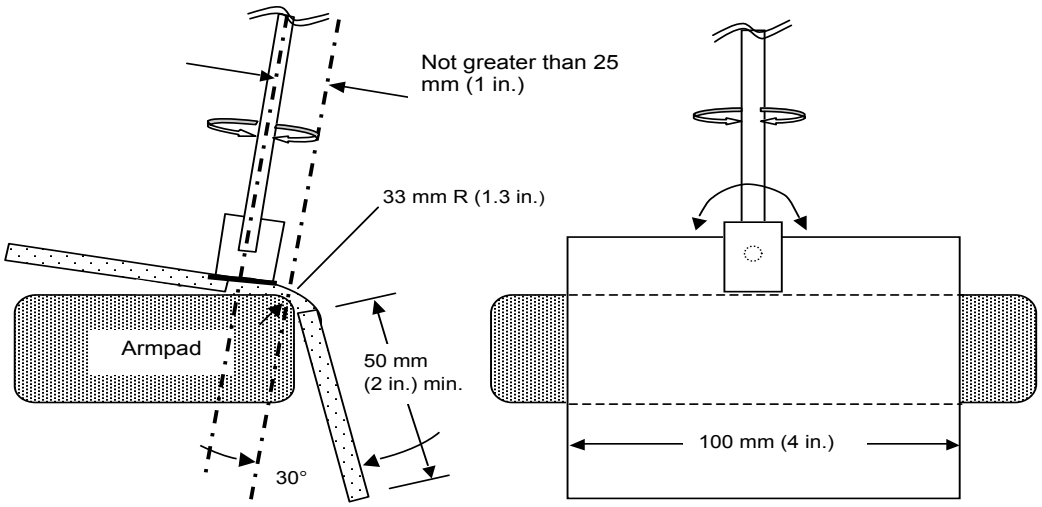



**Figure 20a - Arm Loading Device**

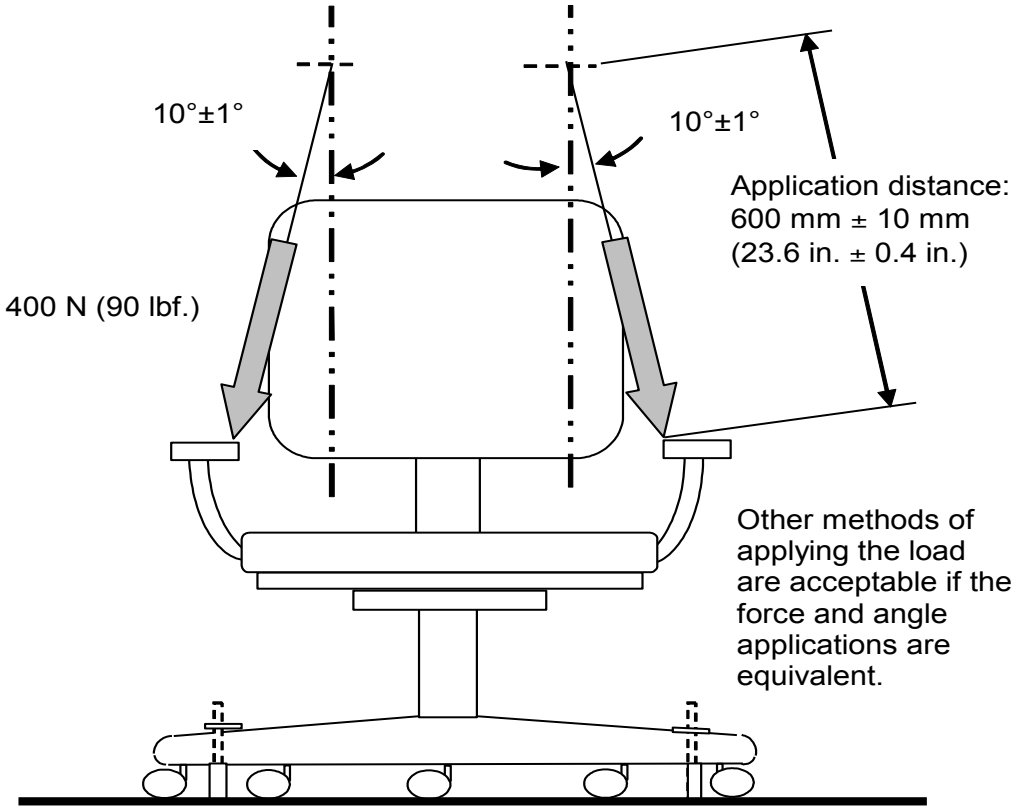



**Figure 20b - Arm Durability Test – Cyclic**

## 20 Arm Durability Test - Cyclic (Figure 20a and 20b)

### 20.1 Purpose of test

The purpose of this test is to evaluate the ability of the chair armrests to withstand stresses that occur as a result of repetitive loading that can be imposed on the armrest structure. Loading of this type is the result of using the armrests as a support when getting into or out of the chair.

### 20.2 Test setup

a) The chair shall be placed on a test platform in an upright position as shown in Figure 20b. If necessary, the seat may be restrained from rotational movement. Clamping shall be done in such a manner as not to restrict the arms of the unit.

b) Height-adjustable arms must be set at the apparent weakest position. When the weakest position is not obvious, several load applications positions may be necessary to properly test the product.

c) Width-adjustable arms must be set at the apparent weakest position.

d) Unrestrained pivoting armrests (i.e., the armrest cap pivots freely) shall be loaded in line with the pivot point.

e) The arm loading device shall distribute the load over a length of 100 mm (4 in.) on the arm pad. Center of load shall not be applied more than 25 mm (1.0 in.) in from the inside edge of the arm pad. One suggested arm loading device is shown in Figure 20a. Position the arm loading device on the armrest structure at its apparent weakest point consistent with using the armrest as a support for entering or exiting the chair.

### 20.3 Test procedure

Simultaneously apply a force of 400 N (90 lbf.) to each arm initially at a 10 degrees ± 1 degree angle as shown in Figure 20b. The arm loading device must follow the arm (allow fore and aft, side-to-side and rotational movement) as it deflects or pivots. If using a test device similar to that shown in Figure 20b, the load application distance must initially be the length specified in the figure. Other methods of applying the load are acceptable if the force and angle applications are equivalent. The force shall be applied and removed for 60,000 cycles at a rate between 10 and 30 cycles per minute.

### 20.4 Acceptance level

There shall be no loss of serviceability to the chair.

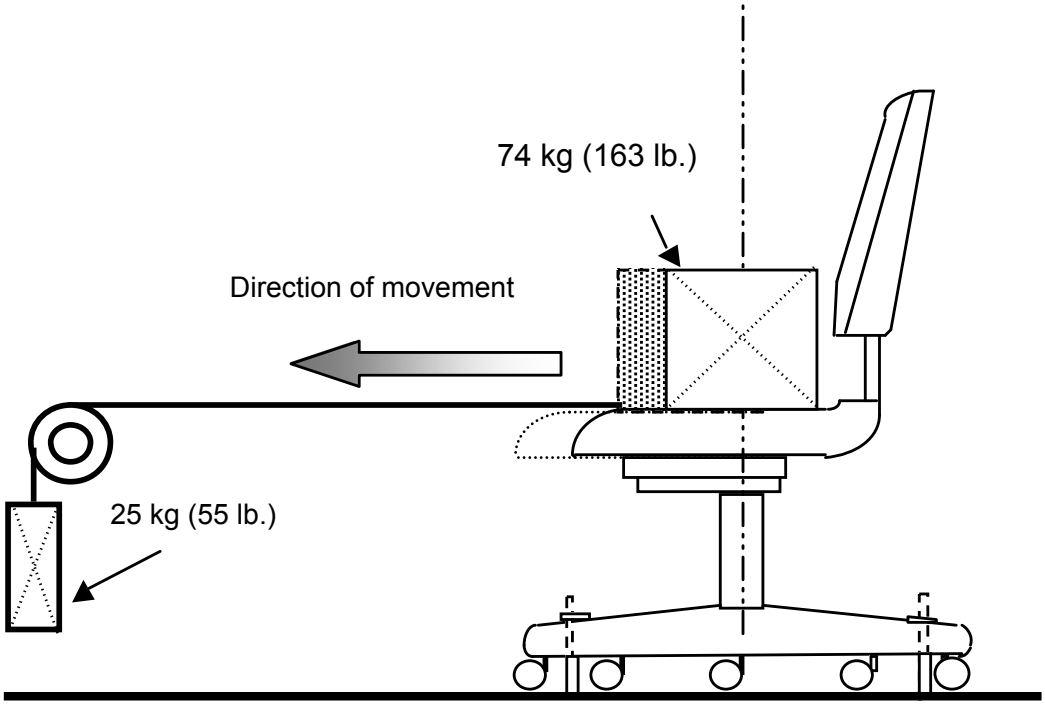



**Figure 21 - Out Stop Test for Chairs with Manually Adjustable Seat Depth**

## 21 Out Stop Tests for Chairs with Manually Adjustable Seat Depth (See Figure 21)

### 21.1 Purpose of Test

The purpose of this test is to evaluate the ability of the seat slide out stops to withstand excessive impact forces that may result from user adjustment of the seat depth.

**Note:** This test does not apply to chairs where seat depth adjustments must occur with the user out of the chair.

### 21.2 Test Setup

a) The chair shall be placed on a test platform and restrained to prevent it from moving. The method of securing shall not interfere with the operation of the seat slide being tested. For chairs with an adjustable seat angle, set the angle to its most forward (negative seat slope) angle. Disable any seat depth adjustment locks or interim stops.

b) A stranded metallic cable or equivalent shall be attached to the most rigid point of the vertical centerline of the seat. This may be accomplished by means of a clamp or similar device that does not affect the test results.

c) The opposite end of the cable shall extend in line forward from the seat and in line with the plane of the seat movement to a pulley and then downward to an attached weight of 25 kg (55 lb.). Place the seat in its most rearward position and restrain.

d) Place a 74 kg (163 lb.) rigid mass in the center of the seat.

### 21.3 Test Procedure

The seat with the hanging weight shall be held at its most rearward position, then released, permitting it to move forward rapidly and impact the out stops. Repeat this procedure for a total of 25 cycles.

### 21.4 Acceptance Level

There shall be no loss of serviceability to the unit.

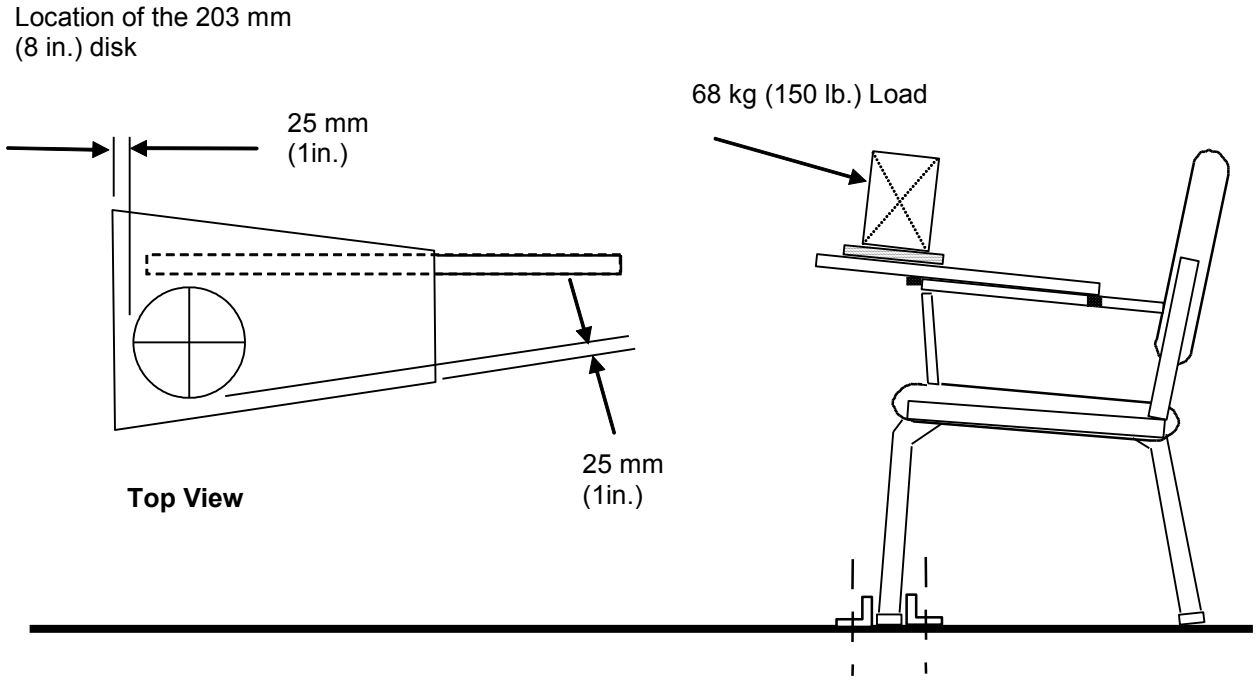



**Figure 22 - Tablet Arm Chair Static Load Test**

## 22 Tablet Arm Chair Static Load Test (See Figure 22)

### 22.1 Purpose of Test

The purpose of this test is to evaluate the ability of the unit equipped with a tablet arm or other attached auxiliary writing/laptop surface to withstand stresses caused by vertical loading.

### 22.2 Test Setup

a) The unit shall be leveled in its normal operating position. The unit shall be placed on a test platform and restrained to prevent movement. Any height adjustment of the chair and/or tablet arm shall be set at the midpoint of adjustment.

b) Apply the load through a 203 mm ± 13 mm (8.0 in. ± 0.5 in.) diameter area 25 mm (1 in.) from the edge of the tablet surface at its apparent weakest point. When the weakest point is not obvious, several load applications may be necessary to properly test the product. If required to prevent tipping of the chair, a counterbalancing force may be applied to the chair seat.

### 22.3 Test Procedure

Apply a load of 68 kg. (150 lb.) at the location described in 22.2 b) for one (1) minute and remove the load.

### 22.4 Acceptance Level

The load applied once shall cause no sudden and major change in the structural integrity of the chair. After performing the test, the tablet arm must allow egress from the unit; other losses of serviceability are acceptable.

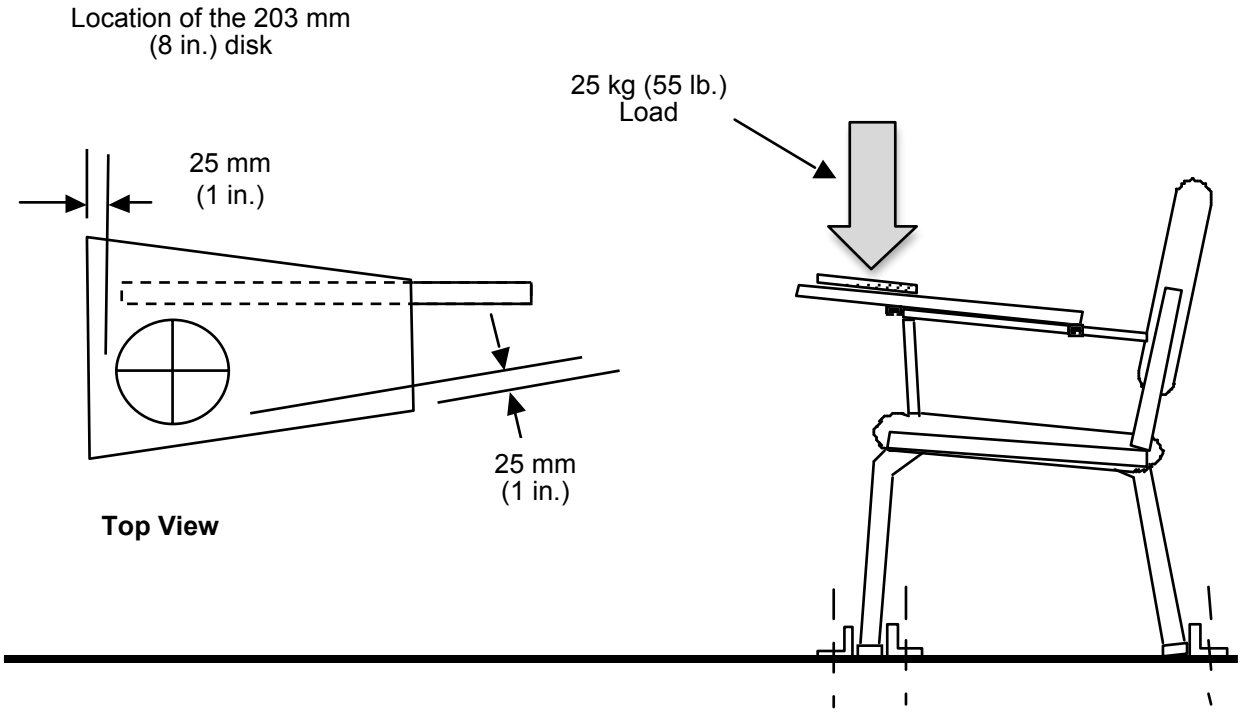



**Figure 23 - Tablet Arm Chair Load Ease Test - Cyclic**

## 23 Tablet Arm Chair Load Ease Test - Cyclic (See Figure 23)

### 23.1 Purpose of Test

The purpose of this test is to evaluate the durability of the tablet arm chair to withstand cyclic loading of the tablet.

### 23.2 Test Setup

a) The unit shall be leveled in its normal operating position. The unit shall be placed on a test platform and restrained to prevent movement. Any height adjustment of the chair and/or tablet arm shall be set at the midpoint of adjustment.

b) Apply a load of 25 kg (55 lb.) through a 203 mm ± 13 mm (8.0 in. ± 0.5 in.) diameter area 25 mm (1 in.) from the edge of the surface at its apparent weakest point. When the weakest point is not obvious, several load applications may be necessary to properly test the product. If required to prevent tipping of the chair, a counterbalancing force may be applied to the chair seat.

c) The cycling device shall be set to operate at a rate of 14 ± 6 cycles per minute.

### 23.3 Test Procedure

a) The load shall be raised until the entire load is off the tablet surface and then eased (without impact) onto the surface, so that it takes the entire load without any support from the cycling device.

b) Repeat Step (a) for a total of 100,000 cycles.

### 23.4 Acceptance Level

There shall be no loss of serviceability to the unit.

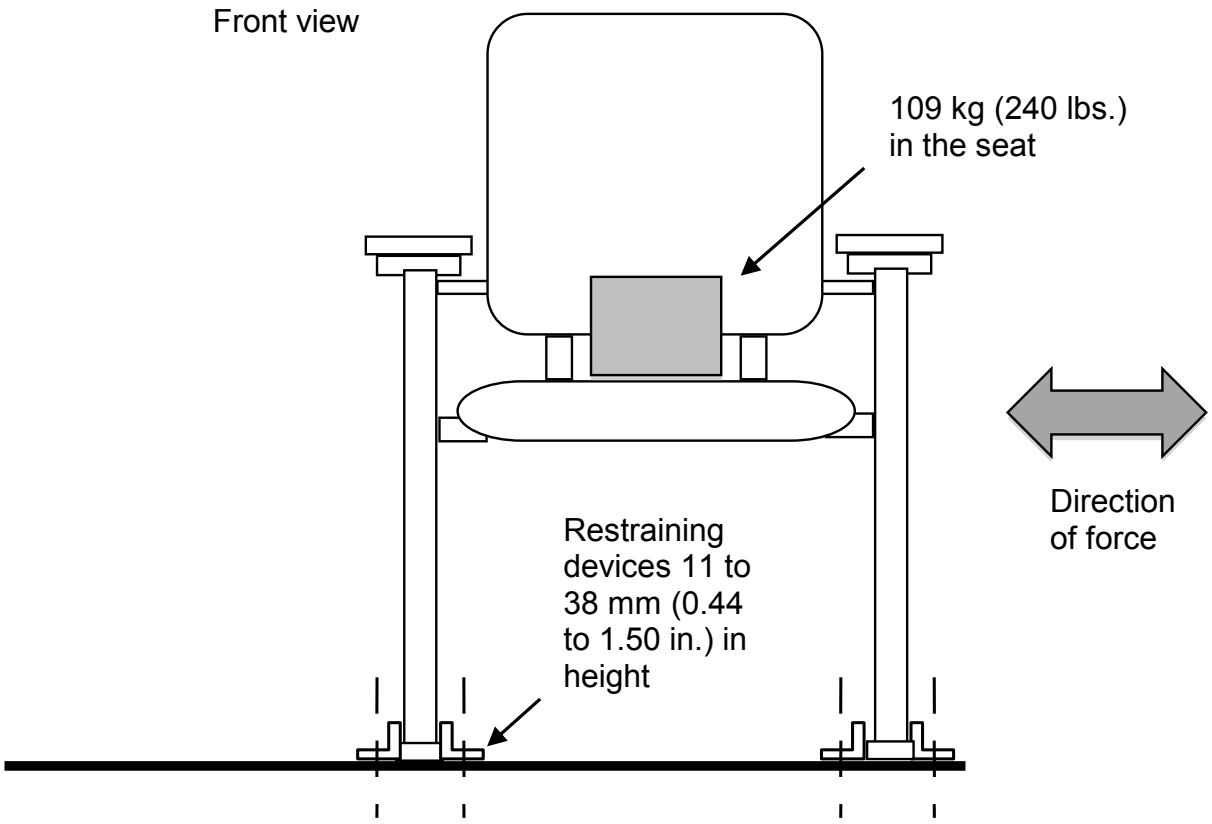



**Figure 24 – Structural Durability Test - Cyclic**

## 24 Structural Durability Test - Cyclic (See Figure 24)

### 24.1 Applicability

This test applies to chairs that do not swivel. It does not apply to chairs with casters or products with seat heights greater than 24 inches.

### 24.2 Purpose of Test

The purpose of this test is to evaluate the ability of the unit to withstand fatigue stresses and wear caused by side-to-side forces on the structural frame.

### 24.3 Test Setup

a) The unit base shall be restrained from horizontal movement on a test surface. Figure 24 shows one acceptable method of restraining the unit. All four corners of the base shall be restrained in both directions.
b) If adjustable features are available, all adjustments shall be set at normal use conditions.
c) Place a weight of 109 kg (240 lb.) in the center of the seat. If necessary to keep the weight in position, the weight may be secured.
d) A cycling device shall be attached to the unit frame midway between front and rear of the seat at the height of the midpoint of the seat frame structure. **Note:** Where design of the unit does not permit attachment at the midpoint as specified above, a bridging device may be used.
e) The cycling device shall be adjusted to apply a “push-pull” action, or alternately may be applied by alternating pull (or push) force application on alternating sides of the unit. One cycle shall consist of one outward force application and removal and one inward force application and removal.
f) Apply a force of 334 N (75 lbf.) at an appropriate rate between 10 and 30 cycles per minute.

### 24.4 Test Procedures

The device shall be cycled for 25,000 cycles.

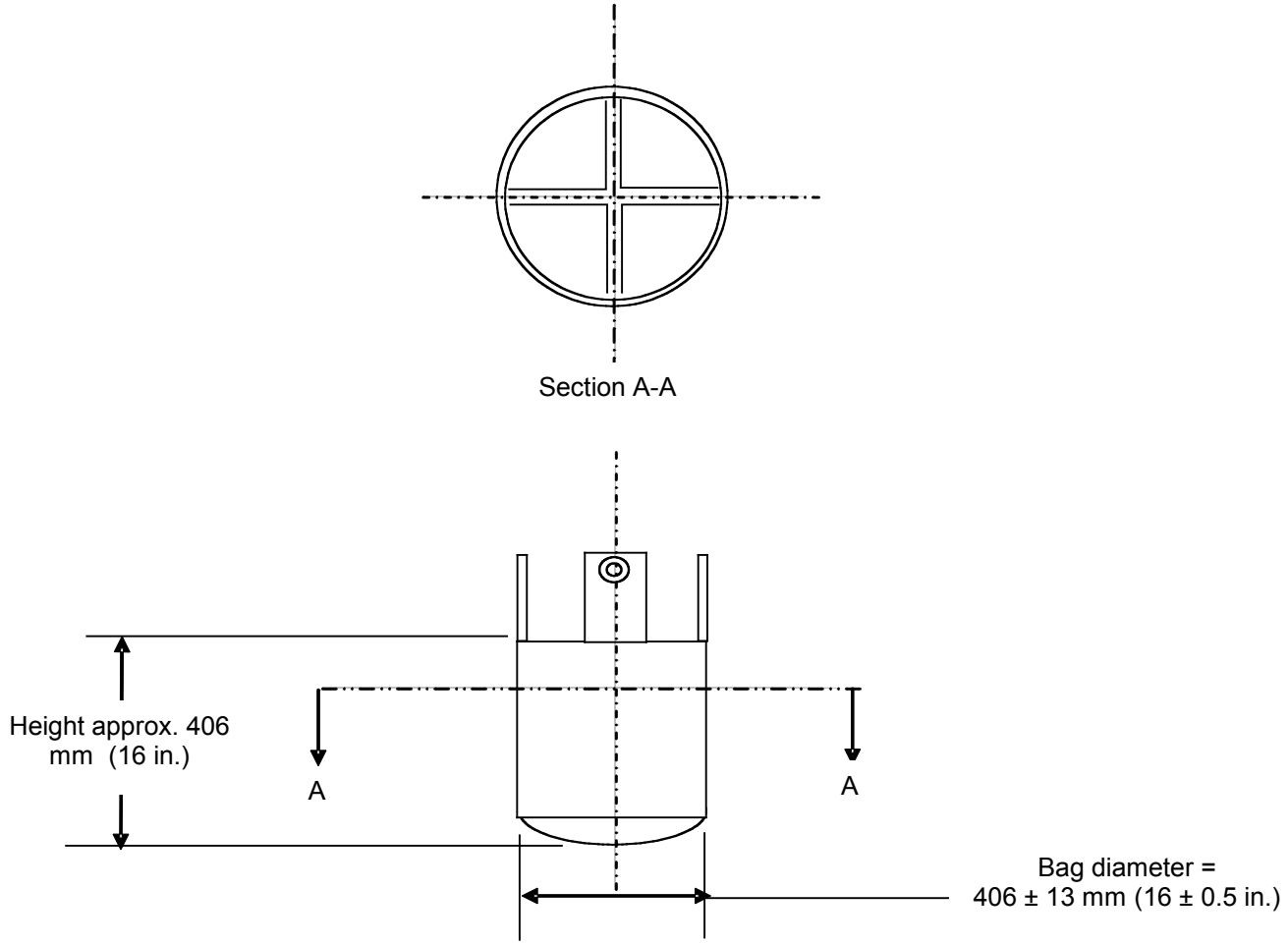
### 24.5 Acceptance Level

There shall be no loss of serviceability.

**Appendix A**

**Impact Test Bag Construction Details**

**Example: 406 mm (16 in.) diameter bag**




Bag to contain a sufficient quantity of metal media to bring the bag to the specified load. Media may be shot, slugs, punches, etc. Media may be contained within smaller individual bags/compartments. Media may not be a singular solid material (e.g. single steel or concrete mass).

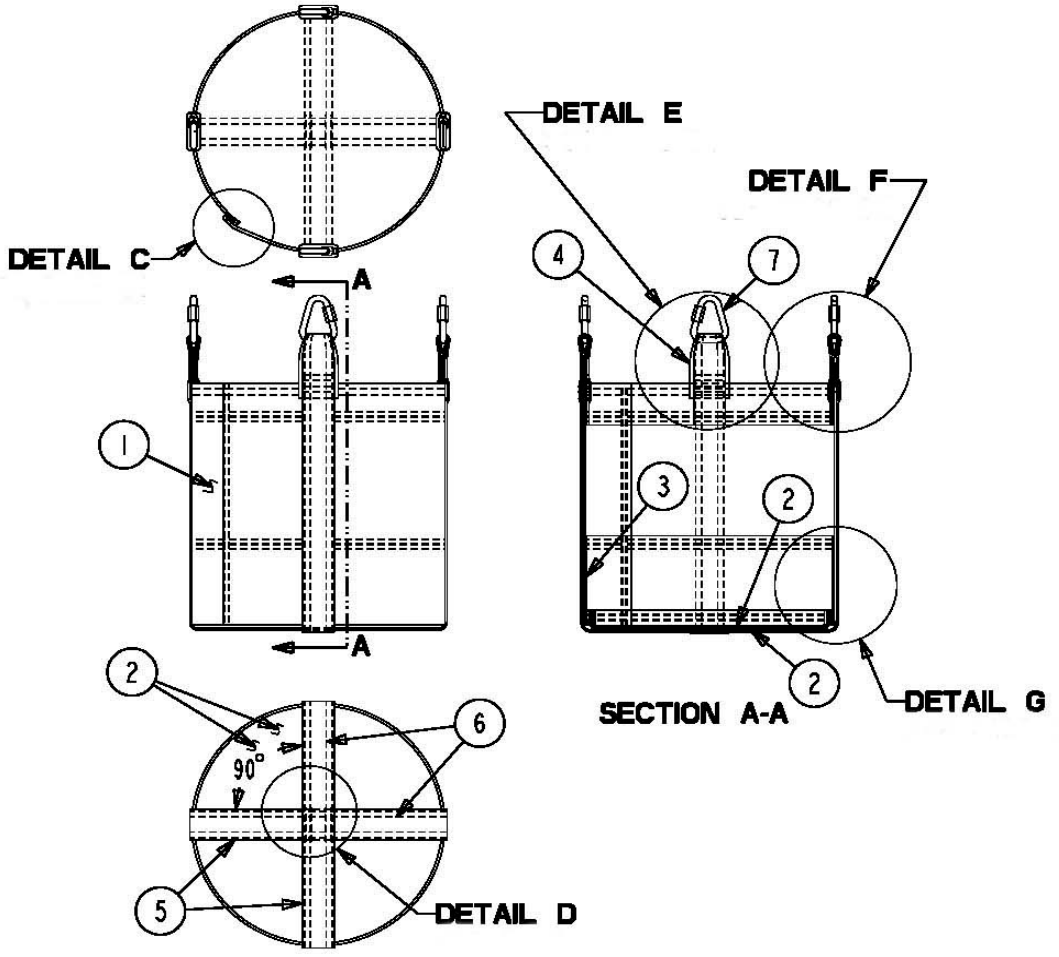
**Note:** For health and environmental reasons, lead shot is not recommended. Other fixtures or media are acceptable if they provide an equivalent impact.

**Note:** All dimensions in Appendix A are per the Imperial System (inches).

**Appendix A continued**
**Impact Test Bag – Typical Construction**

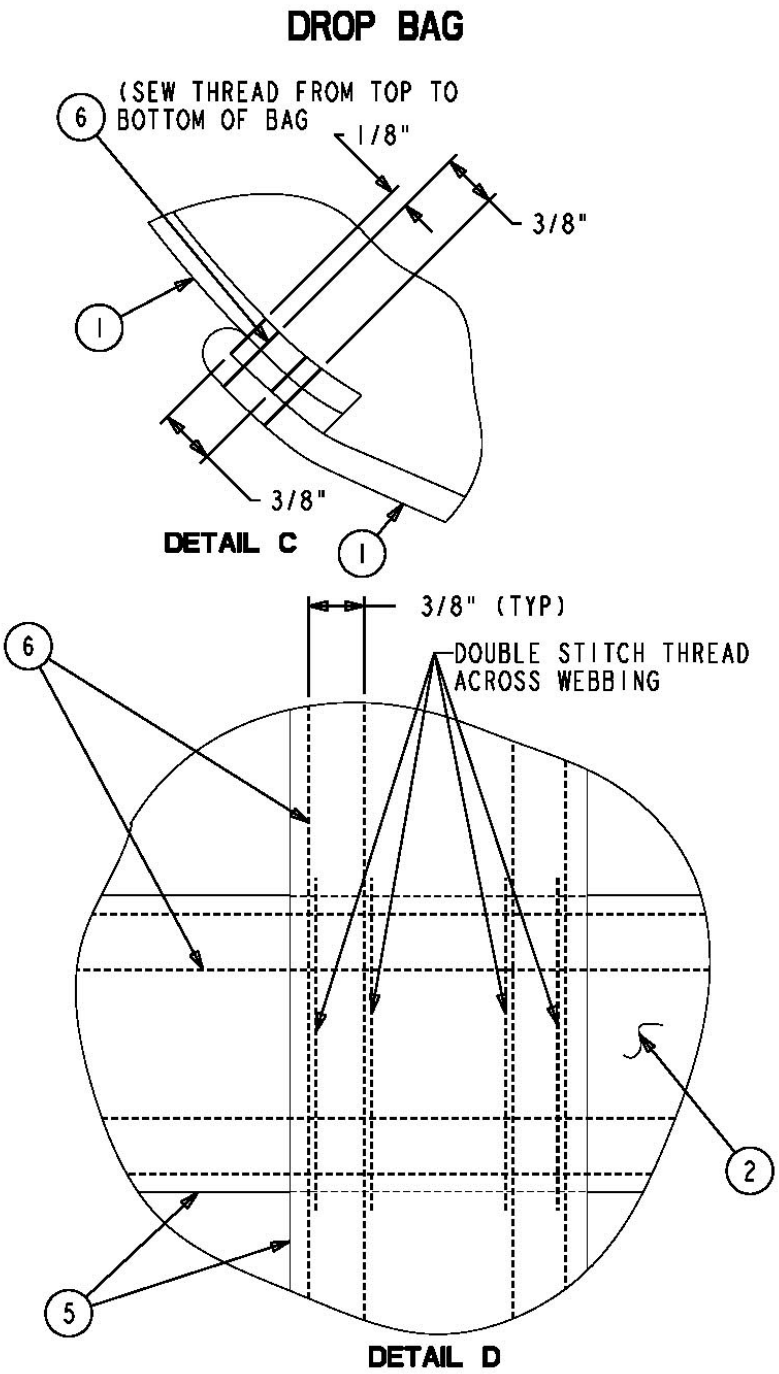
# DROP BAG

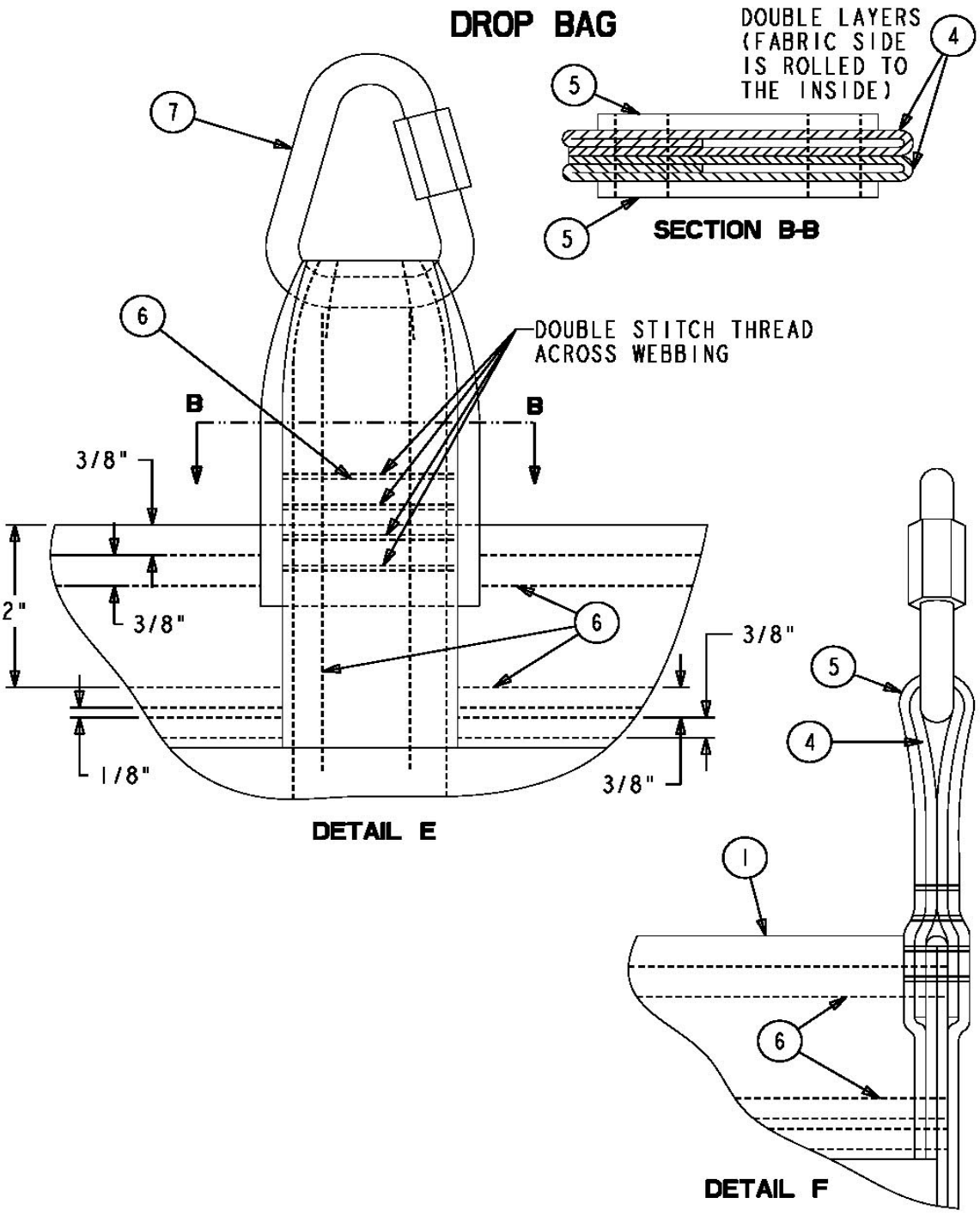
| DET NO | DESCRIPTION | MATERIAL | QTY |
|---|---|---|---|
| 1 | SIDE PANEL | 22 OZ. VINYL COATED POLYESTER | 1 |
| 2 | BOTTOM PANEL | 22 OZ. VINYL COATED POLYESTER | 2 |
| 3 | INSIDE PANEL | 22 OZ. VINYL COATED POLYESTER | 1 |
| 4 | REINFORCEMENT | 22 OZ. VINYL COATED POLYESTER | 4 |
| 5 | WEBBING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



**Impact Test Bag - Typical Construction**

**Impact Test Bag - Typical Construction**



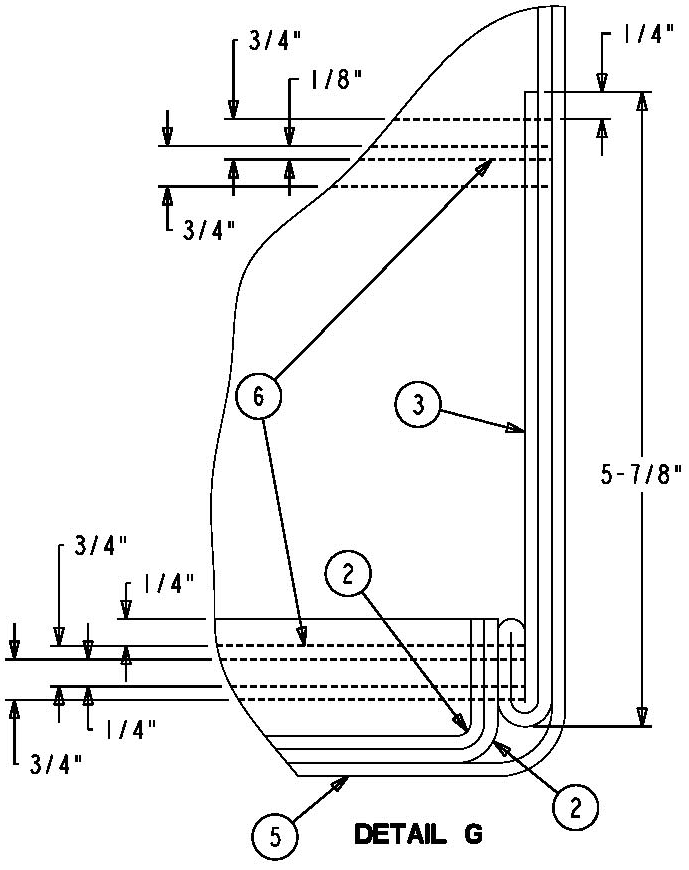

DROP BAG
DOUBLE LAYERS (FABRIC SIDE IS ROLLED TO THE INSIDE)
4
5
5
SECTION B-B
7
6
DOUBLE STITCH THREAD ACROSS WEBBING
B
B
3/8"
2"
3/8"
6
3/8"
1/8"
3/8"
DETAIL E
5
4
1
6
DETAIL F

**Impact Test Bag - Typical Construction**

# DROP BAG

BAG CONSTRUCTION:

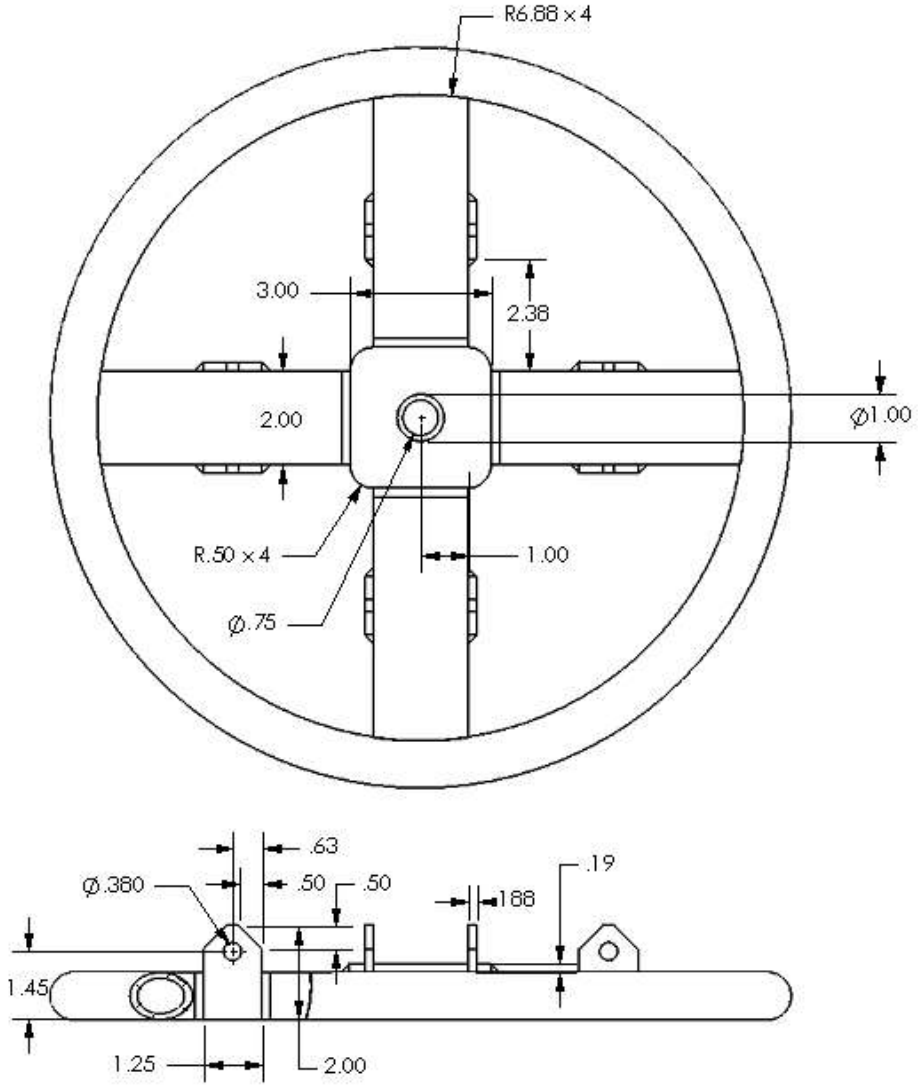
1. THE BAG IS TO BE SEWN TO BE 16" OUTSIDE DIAMETER AND 16" DEEP.
2. THE BAG IS CONSTRUCTED AS SHOWN ON ALL SHEETS.
3. THE TWO LIFTING STRAPS ARE OF 2" WIDE POLYESTER WEBBING SEWN IN AT 90° TO ONE ANOTHER ON THE OUTSIDE OF THE BAG.
4. THEY EXTEND DOWN ONE SIDE OF THE BAG, UNDER THE BOTTOM AND UP THE OTHER SIDE.
5. THE STEEL LIFTING RINGS ARE SEWN INTO THE FOUR ENDS OF THE TWO STRAPS.



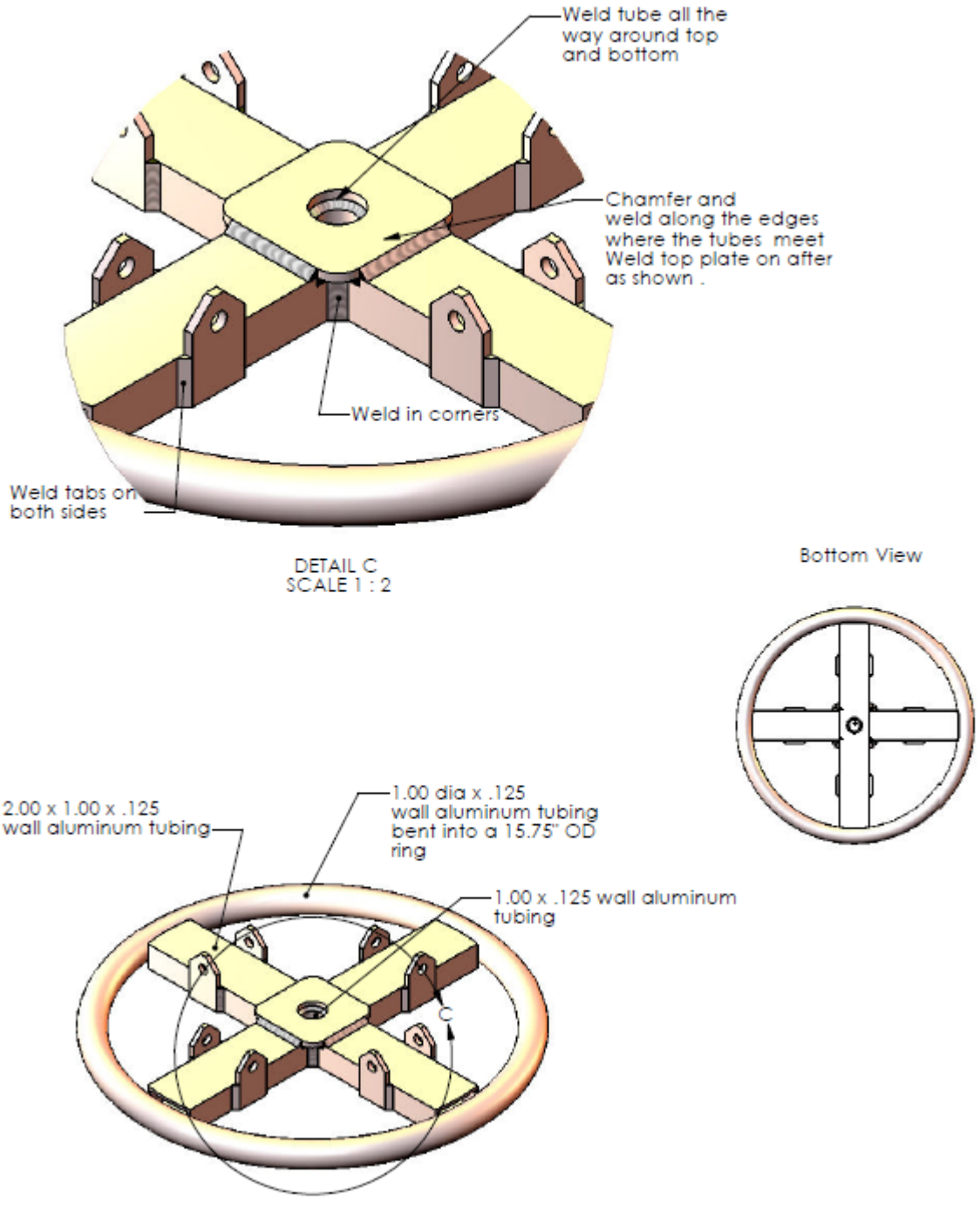

DETAIL G

**Test Bag Handling Suggestions:**

Support fixtures for lifting and attaching the bag to test devices may be used to help maintain the shape of the bag and provide improved consistency, depending on the media chosen. Examples of support fixtures are shown below:



**Appendix A continued**

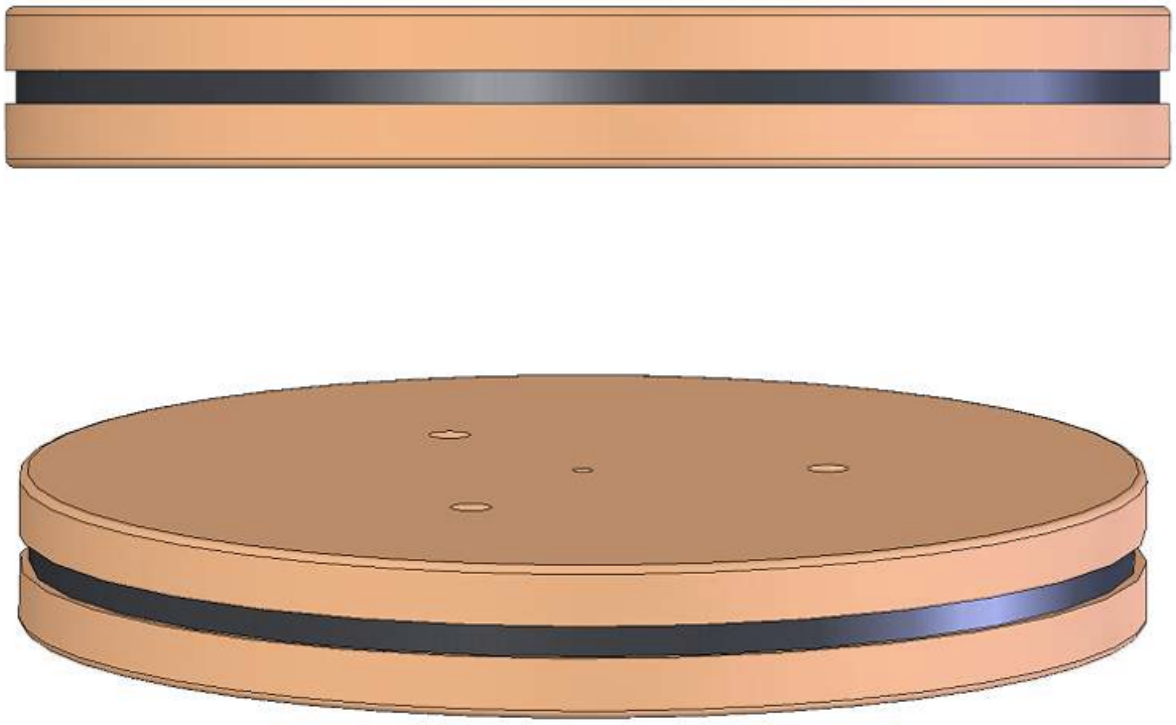



**Note:** Other designs may be used to help maintain the shape of the bag and provide improved consistency.

**Appendix B**
**Stability Disk – Construction Details**

The disks shall weigh 10 kg ± 0.05 kg (22 lb. ± 0.11 lb.) each, having a diameter of 350 mm (13.8 in.) and a thickness of 48 mm (1.9 in.). The center of gravity shall be in the center of the disk. The surface friction of the disk (disk to disk) shall be such that the force to initiate motion shall be 31 N ± 9 N (7 lbf. ± 2 lbf.).

One acceptable construction of the disk is a sandwich construction consisting of two medium density fiberboard (mdf) outer plates with steel plates sandwiched in between them. The steel plates have through holes drilled out for the screws and additional holes symmetrically drilled to achieve the total weight required. The entire construction is held together with counter-sink screws into threaded inserts.



**One acceptable construction of the disk**

**Appendix C - Informative**

**Base Test – Static**

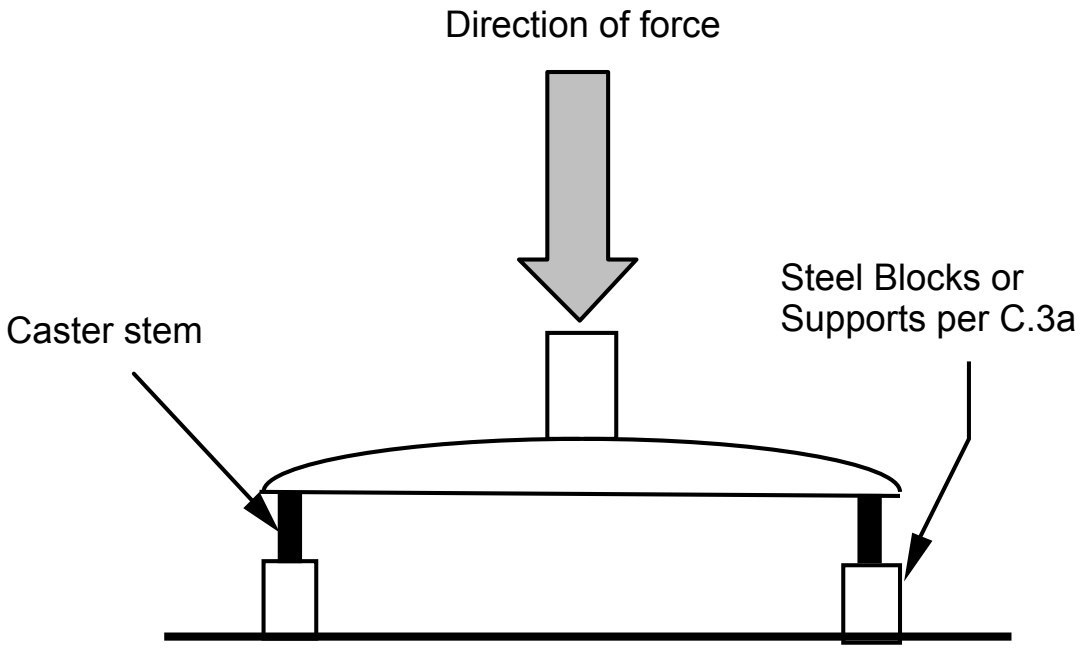



**Figure C - Base Test - Static**

## Appendix C – Informative

**Base Test - Static** (See Figure C)

### C.1 Applicability

The test may be performed on pedestal bases as a quality control component test.

### C.2 Purpose of Test

The purpose of this test is to evaluate the ability of a pedestal base to withstand excessive vertical forces.

### C.3 Test Setup

a) Remove the casters or glide foot (caster/glide stems shall remain in place). Caster/glide stems are required for support. If caster/glide stems are not available, a suitable fixture may be used to simulate the stem. Place the stems on support blocks as shown in Figure C. The blocks or supports shall be of sufficient height to prevent the center column and/or legs from touching the test platform during the test. If the base has glides with a non-removable stem, the glides shall remain in place and be placed on blocks or supports. Remove the seat support mechanism(s) and height adjustment mechanism (if applicable) from the base. Apply the load to the vertical support column, or test fixture that simulates the taper/base interface.

b) The base legs shall be allowed to move laterally and the center of the base to move vertically as the force is applied. The blocks or supports shall support the base in a manner and location similar to the original casters/glides and shall not impede the deflection and/or lateral motion during the test. Blocks or supports shall not lessen the severity of the test.

### C.4 Test Procedures

a) A force of 11,120 N (2500 lbf.) shall be applied for one (1) minute.
b) Remove the force.
c) Apply a second force of 11,120 N (2500 lbf.) for one (1) minute.
d) Remove the load.

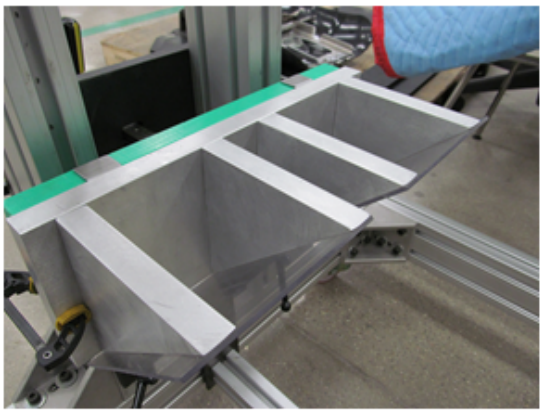
### C.5 Acceptance Level

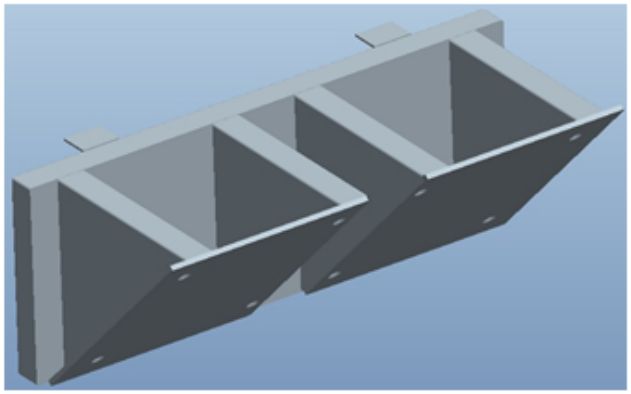
There shall be no sudden and major change in the structural integrity of the base. The center column may not touch the test platform during the load applications.

## Appendix D - Informative

## Front Stability Load Locator Fixture Construction Details

(Front Stability Load Point 45 Degree Load Head)





**Applicability:** This optional fixture may be used for locating the load point for Front Stability (Section 11.4) when it is difficult to determine the 60 mm (2.4 in.) load point from the front center edge of the load-bearing surface of the seat. Often this is difficult to accomplish with upholstered seating and this fixture offers a consistent method.

**Method:** The photo on the left shows the fixture on the ISO CMD gantry with a suggested horizontal force of 40 N (same as ISO TR 24496 CMD placement). Apply the fixture to the front center edge of the seat pan. Scribe / mark a point 60 mm (2.4 in.) horizontally from the point of contact. Use this point per Section 11.4. The following pages show examples of determining the load point.

**Dimensions / Materials:** The following pages offer suggestions for constructing this fixture.

**Appendix D – continued**

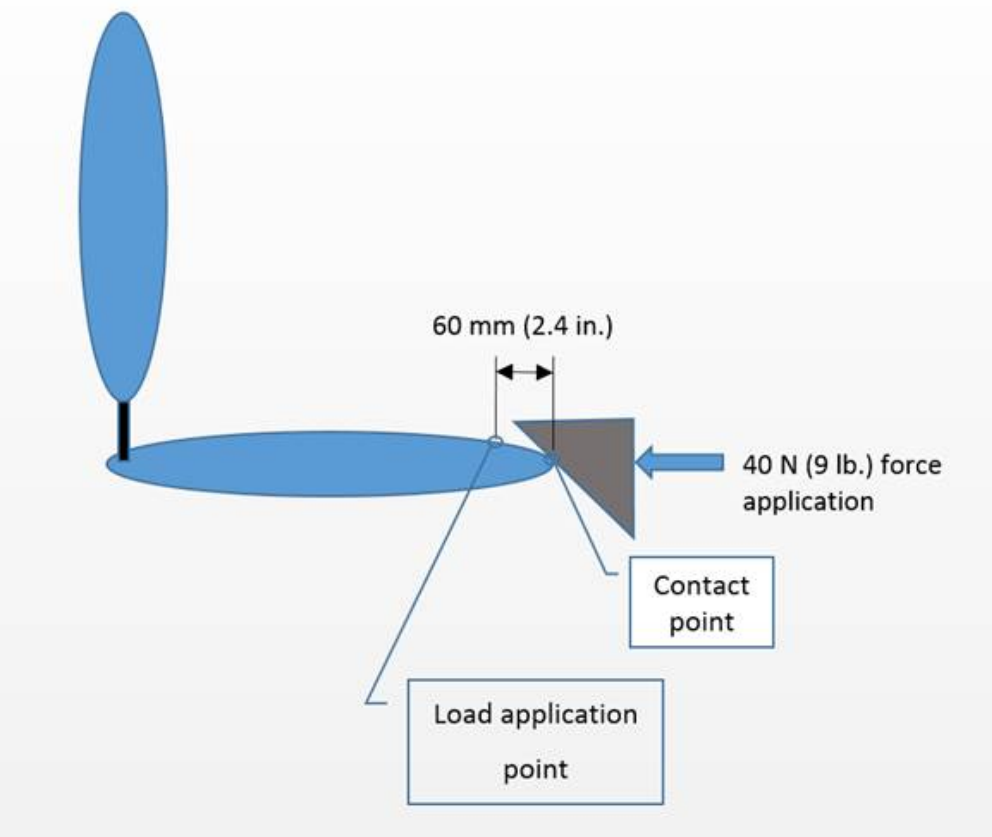



**Figure D – Examples of Determining Load Location for Front Stability**

**Appendix D – continued**

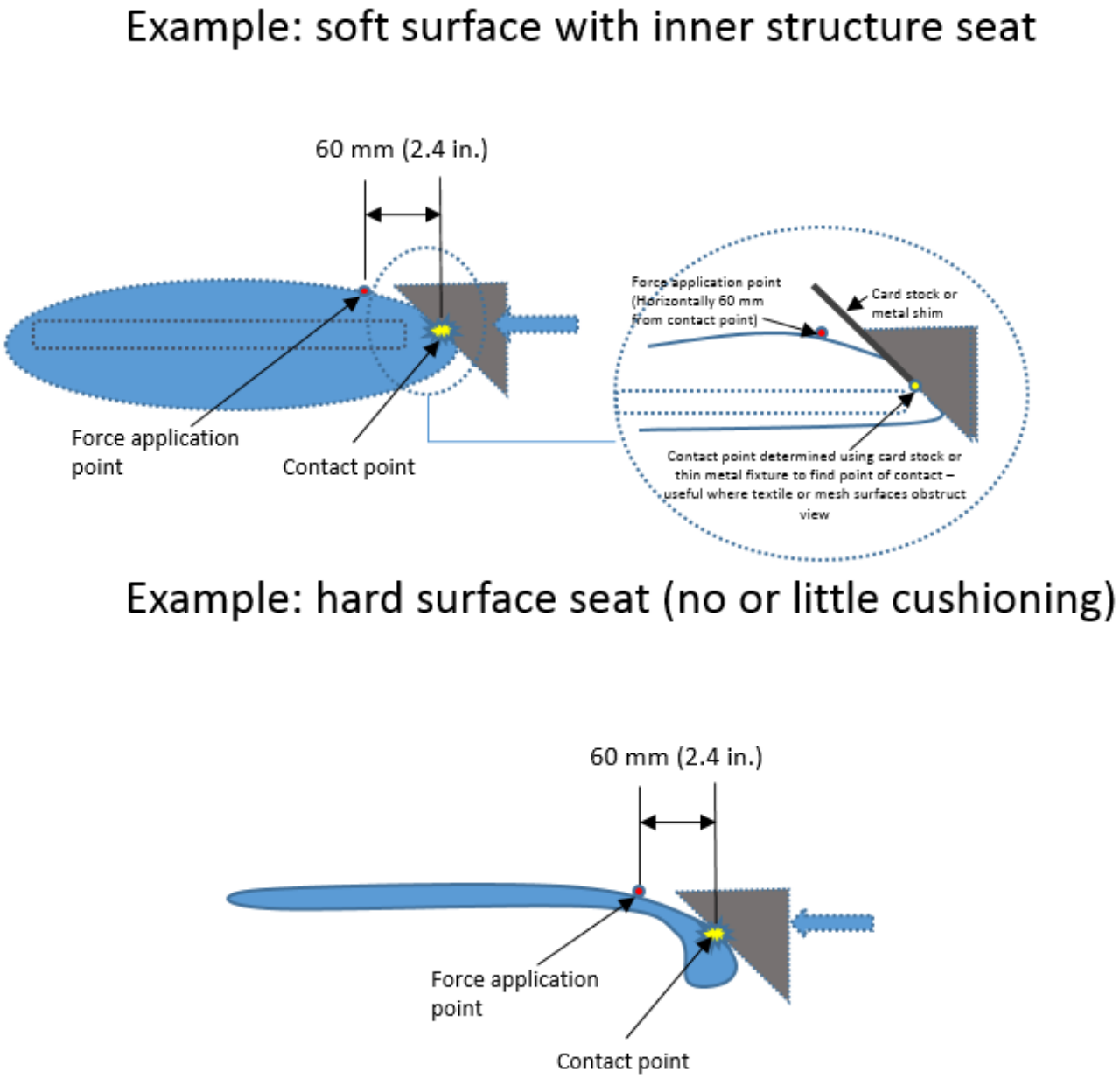
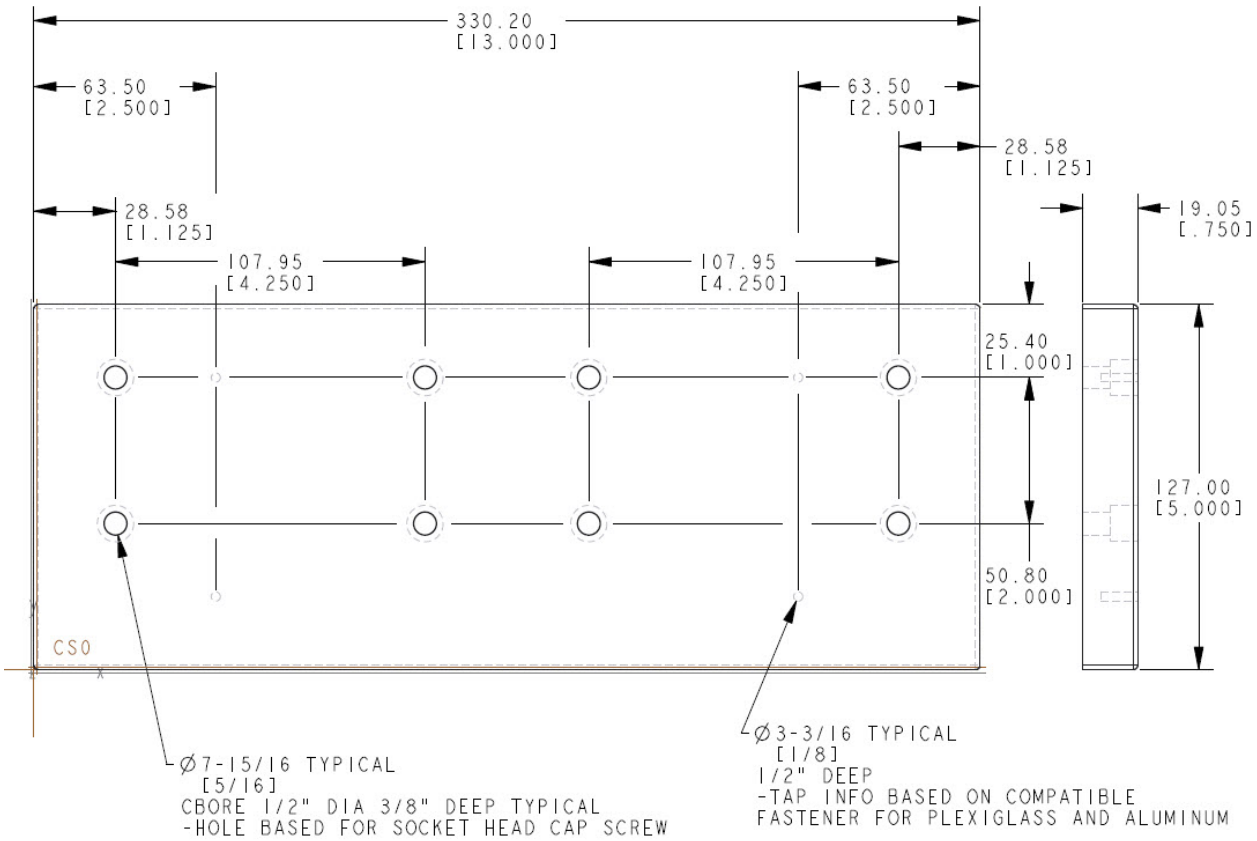



**Figure D cont. – Examples of Determining Load Location for Front Stability**

**Appendix D - continued**

**Front Stability Load Locator Fixture Construction Details**

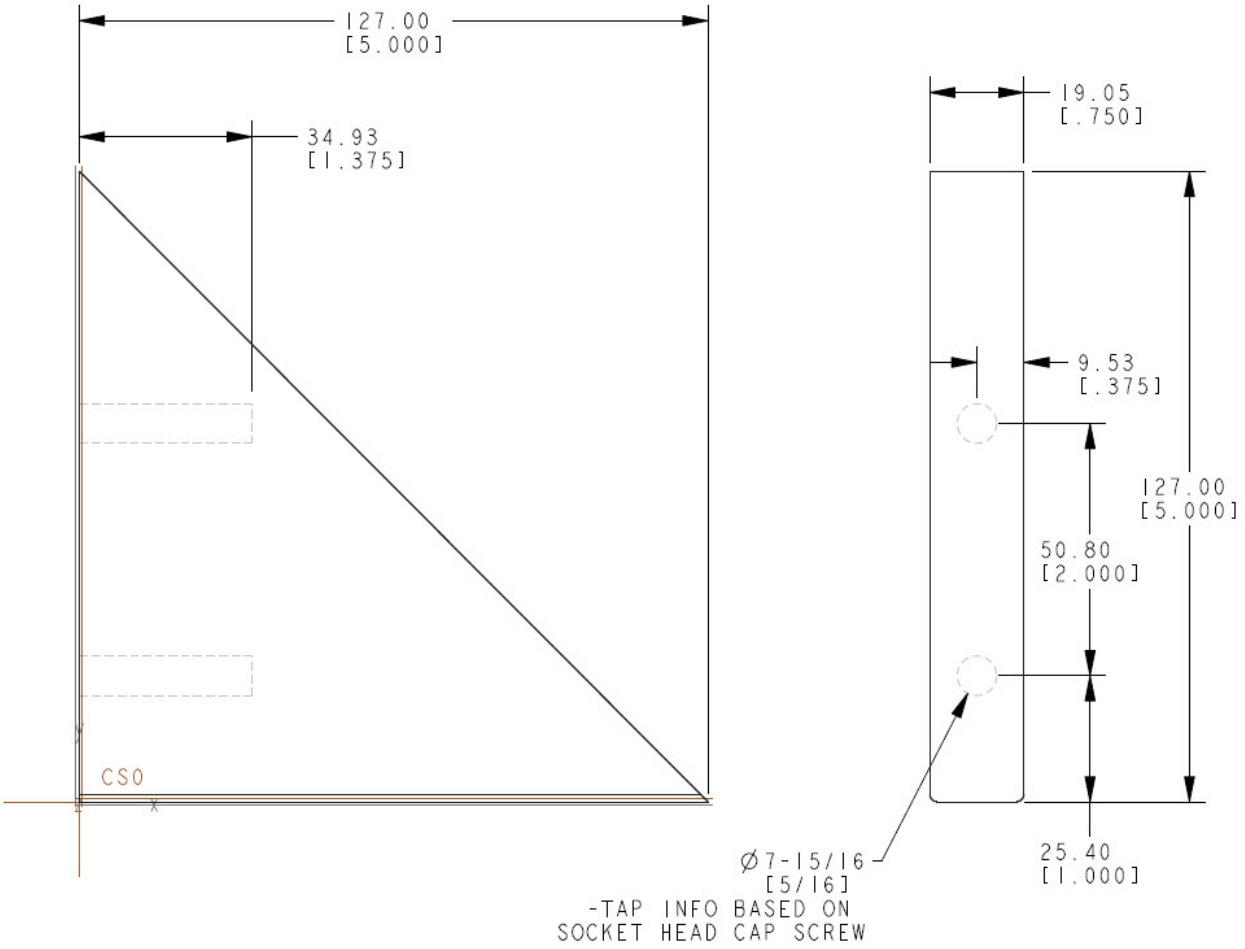
Aluminum



**Appendix D - continued**

**Front Stability Load Locator Fixture Construction Details**

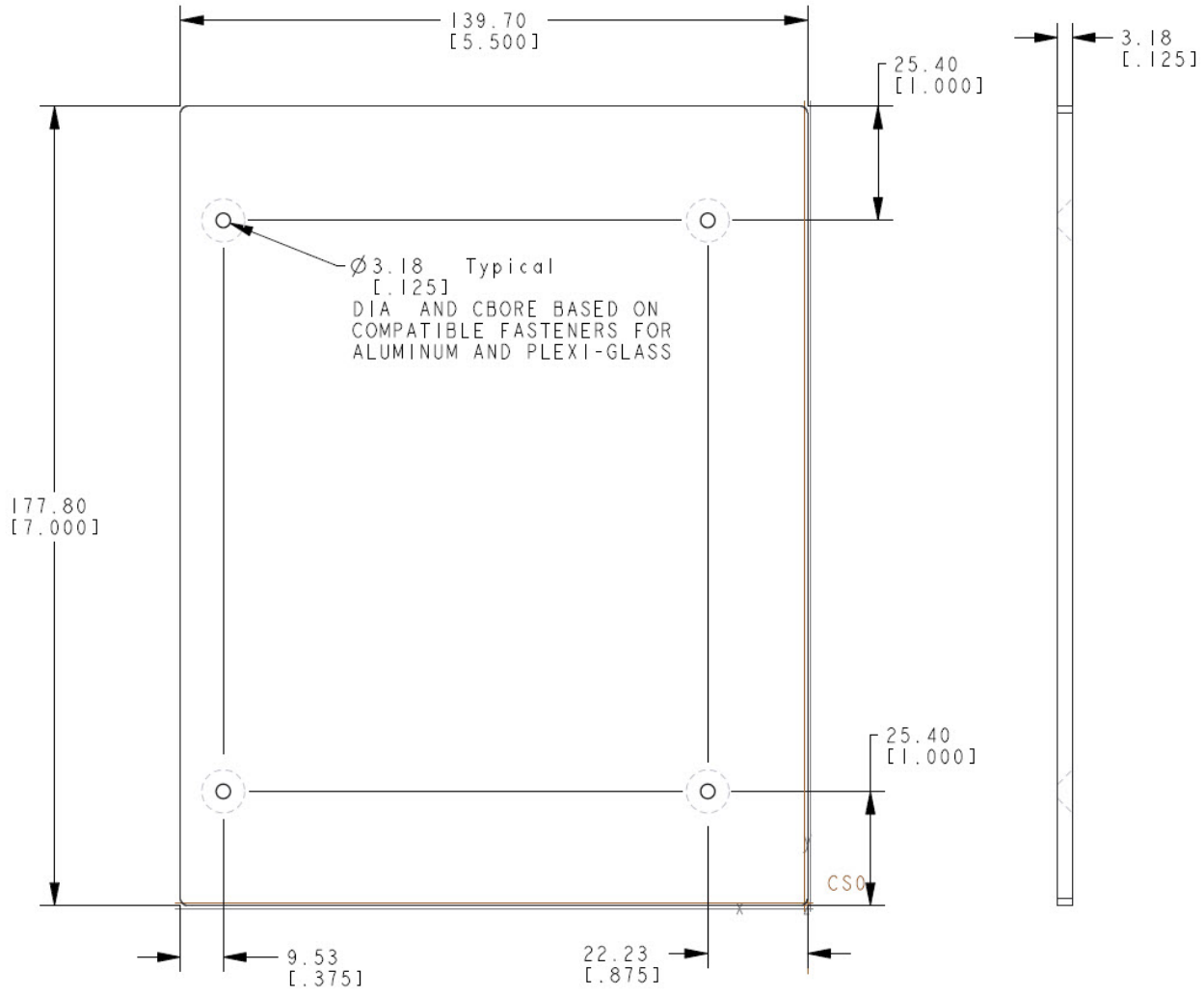
Aluminum



**Appendix D - continued**

**Front Stability Load Locator Fixture Construction Details**

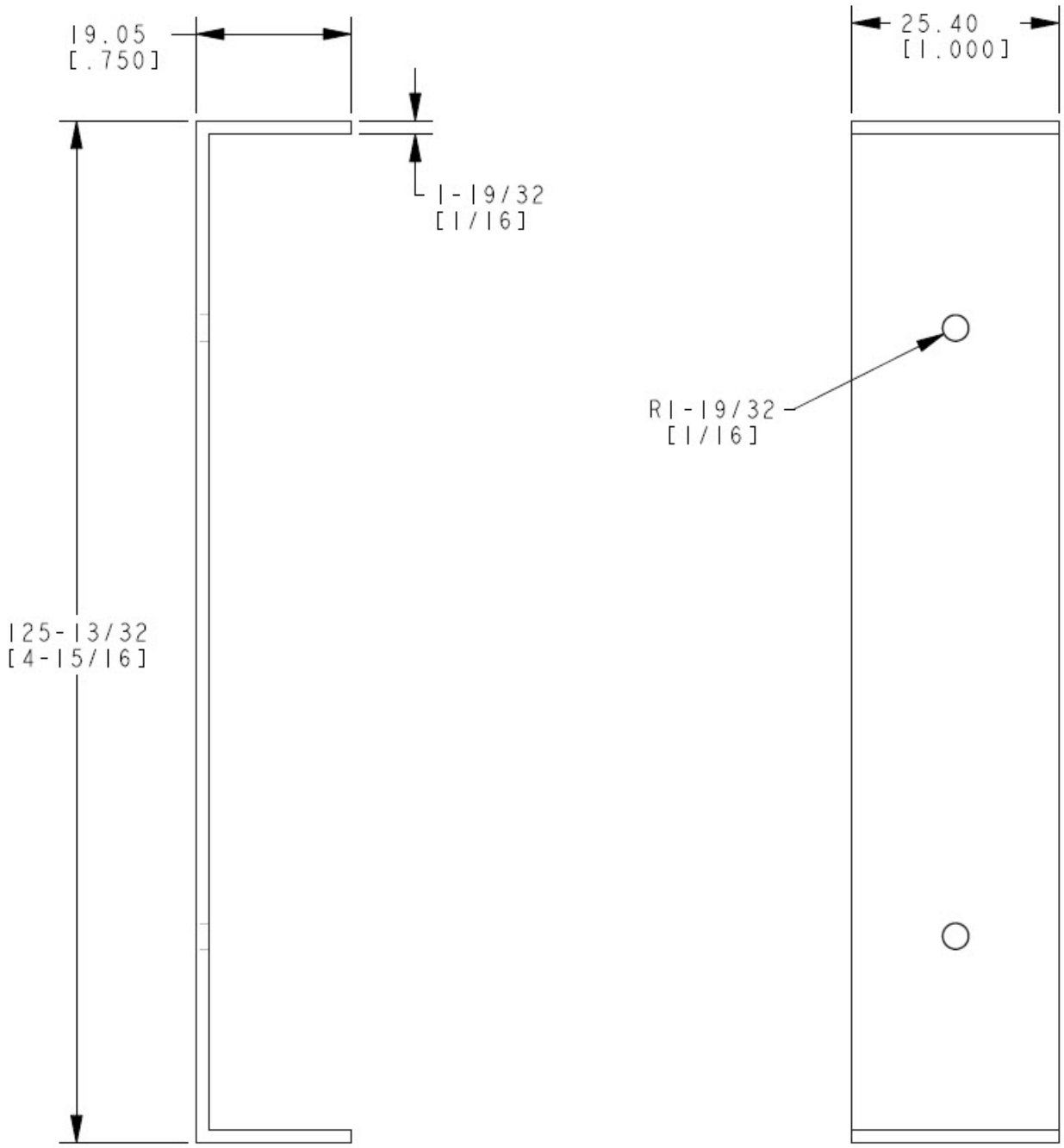
Plexiglass



**Appendix D - continued**

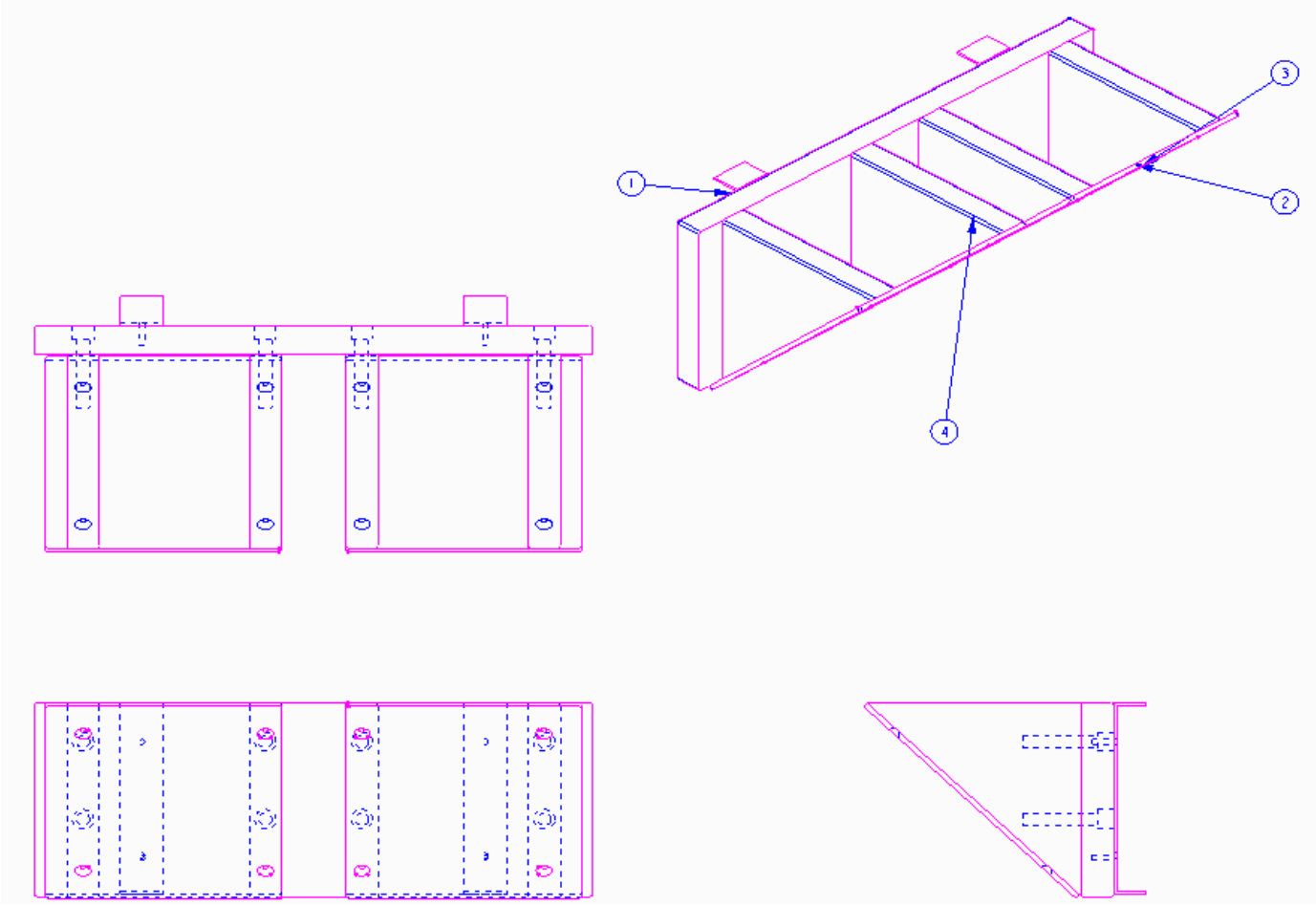
**Front Stability Load Locator Fixture Construction Details**

Steel



**Appendix D - continued**

**Front Stability Load Locator Fixture Construction Details**



## Informative Appendix E - BIFMA Position – Chair Weight Limits / Load Ratings

Chair manufacturers often make claims of the weight capacity or a load rating of their chairs. The BIFMA Seating Subcommittee cautions against weight limit claims that are based on simple static load tests that do not represent actual use conditions and do not encompass dynamic forces. The ANSI/BIFMA standards are based on user behaviors (including dynamic forces) and the environment, not solely on the weight of users. Because of these reasons, there is not a BIFMA 'load-rating' methodology.

The Scope of BIFMA Seating Standards indicates that certain percentile human body weights were used in the development of the various standards. This does not mean that users with weights above the percentiles referenced in the standards cannot safely or comfortably use a chair developed to a given BIFMA standard. As users get very large, however, the size of the chair as well as the capacity must be increased. Users with weights above the listed percentile may affect the life of the chair, and comfort may be compromised.

Some BIFMA members have recently tested general-purpose chairs with static loads of 1,000 lbs. or more. Although these chairs support the load, they know that a dynamic force created by a user of this size could be catastrophic. Responsible manufacturers would never make a user weight recommendation of 1,000 lbs. for a General-Purpose Chair based solely on static loading, knowing the limitations of dynamic use.

When making buying decisions BIFMA cautions purchasers against using load-rating claims only. Such ratings alone are misleading and will not be indicative of the life or strength of the chair. Look for compliance to one of the ANSI/BIFMA standards as they are comprehensive and incorporate a wide variety of test use conditions, including the weight of occupants.

**Informative Appendix F - Summary of Significant Changes**

**Scope –** added nesting folding chairs and 275 lbs. was 253 lbs.
**Definitions –** added general-purpose office chair, general-purpose large occupant office chair, nesting folding chair, and leg-base; and modified form fitting device and tablet arm
**General –** added reference to ISO CMD, revised tolerance language, and added a temperature and humidity suggestion
**Backrest Strength –** 70 degrees for Type I and II was 90 degrees, and forces modified for all Types (harmonized to 150/225 lbf. – formerly 200/300 for Type I and formerly 150/250 for Type II and III), Type I and II combined (was Type II and III combined). Added **Note**: For this test, the test platform may be placed at an angle to facilitate testing/load application.
**Base Test –** moved to Informative Annex (thus no longer Normative)
**Drop Test –** added requirement that if applicable a center column may not touch the platform/floor during the functional drop (raised platform or hole in test platform is acceptable).
**Swivel Test –** 270 lbs. was 250 lbs.
**Tilt Mechanism Test –** 240 lbs. was 225 lbs.
**Seating Durability –** clarified Bag requirements and 200 lbf. was 165 lbf. Drop height of 36mm (1.4”) was 30mm (1.2”). For 5-star base with casters, one leg is placed forward and the caster on that leg is oriented 90 degrees. All casters are oriented at 90 degrees for pedestal base chairs and front to back for 4 leg chairs. For Impact test: **Note:** For chairs with lockable seat angles, the seat shall be tested in the unlocked position.
**Stability Tests –** added rear stability disk locating method and require pulling back to full tilt position when loading disks (new method is optional for Type I and II). Added reference to optional fixture for locating the front stability load point.
**Arm Strength Vertical –** proof test at 15 seconds was 1 minute
**Arm Strength Horizontal –** proof test at 15 seconds was 1 minute
**Backrest Durability –** load in seat of 240 lbs. was 225 lbs. Added note regarding tilt lock mechanisms for Type II / III.
**Caster Durability –** added notes and clarifications, 30” +/- 2 was 30” minimum, 270 lbs. in the seat was 250 lbs., Caster/Chair Frame Durability Test for Non-pedestal Chairs with Casters was Caster/Chair Frame Durability Test for Chairs with Legs
**Leg Strength –** no significant change (note Informative Annex H offers Simultaneous Side test)
**Footrest Tests –** applicable to units with seat heights of 24 inches or greater for durability.
**Armrest Durability –** no significant change
**Outstop –** no significant change
**Tablet Arm Static Load –** no significant change
**Tablet Arm Load Ease –** 55 lbs. at 1” was 77 lbs. centered
**Structural Durability** – new test similar to that found in ANSI/BIFMA X5.11
**Appendix A Test Bag –** no change

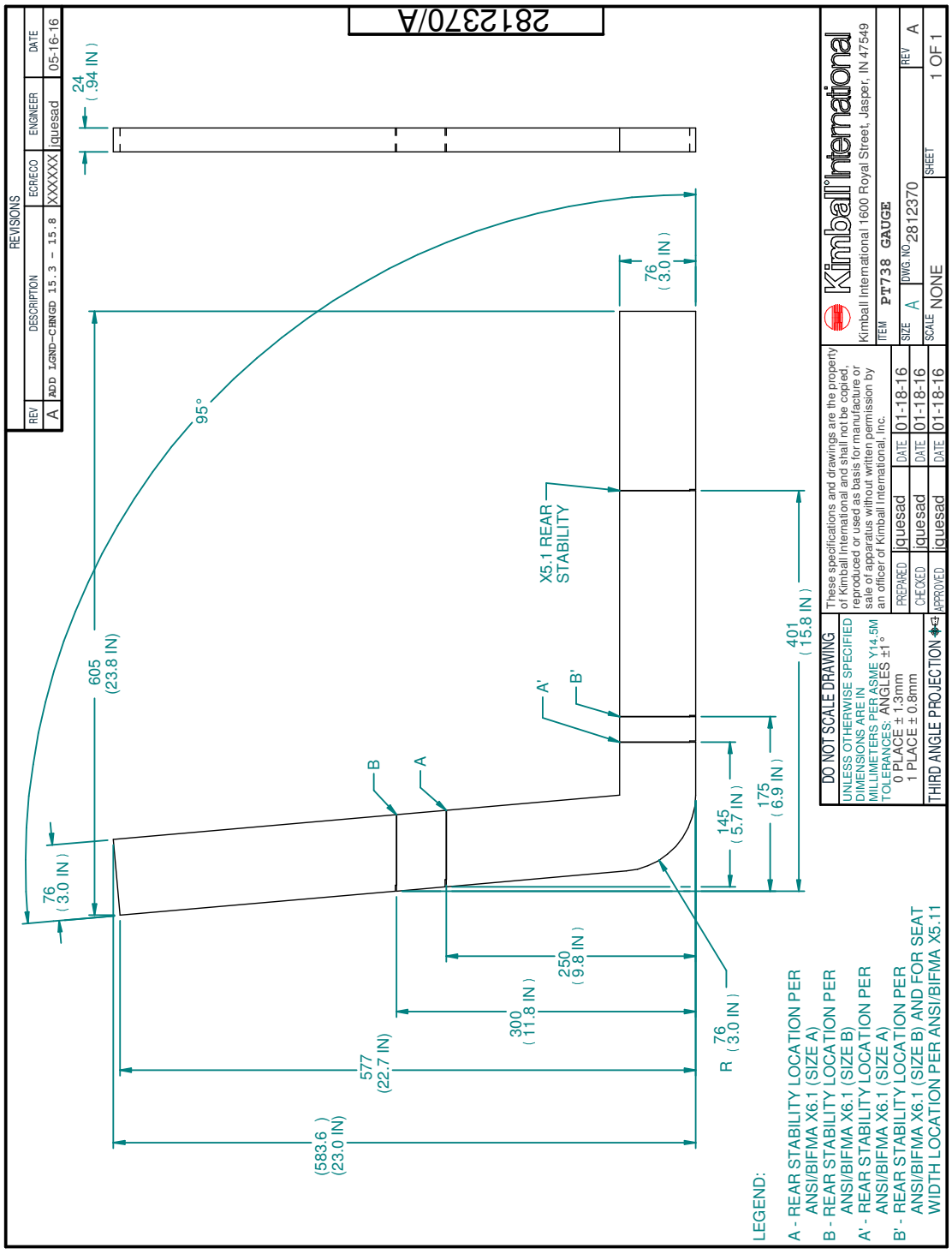
**Appendix F – continued**

**Summary of Significant Changes**

**Appendix B Stability Disk –** no change
**Appendix C Base Test –** was previously normative Section 7
**Appendix D Front Stability Load Locator Fixture –** new informative
**Appendix E Weight Loads / Ratings –** new informative
**Appendix F Summary of Changes –** new informative
**Appendix G Template for Rear Stability –** new appendix
**Appendix H Simultaneous Side Legs Strength Test –** new informative
**Appendix J Figure of Leg-Base Chair –** new informative

## Appendix G

## Template for Rear Stability




**Note:** This template may also be used in ANSI/BIFMA X5.11-2015 and ANSI/BIFMA X6.1-2012

## Informative Appendix H – Simultaneous Side Legs Strength Test

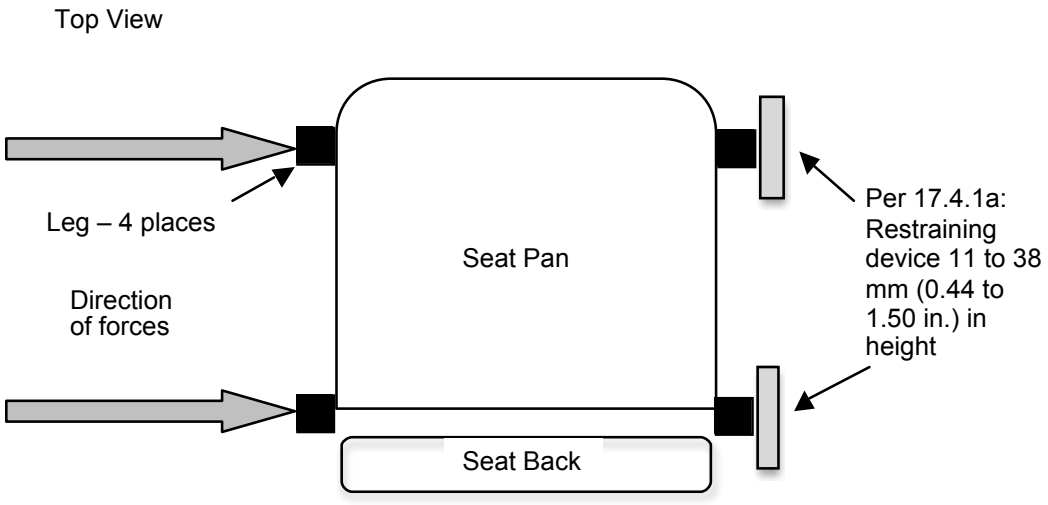



**Figure H – Leg Strength Test – Side Applications**

**Appendix H – continued**

**Informative - Simultaneous Side Legs Strength Test** (See Figures 17a and H)

## H.1 Applicability

This informative test applies to all chairs with legs, including leg bases. See definitions 2.17 and 2.25.

## H.2 Purpose of Test

The purpose of this test is to evaluate the ability of legs to withstand horizontal forces.

## H.3 Simultaneous Side Load Test

### H.3.1 Test Setup

a) The chair shall be placed on a test platform with the side legs restrained by a block 11 to 38 mm (.44 to 1.50 in.) high. Figure 17b and Figure H shows one acceptable method of restraining the chair.

b) If adjustable features are available, all adjustments shall be set at normal use conditions.

c) The loading device shall be attached to the chair so that initially horizontal forces are applied inward and parallel to the side-to-side axis of the chair, between 13 mm (0.5 in.) and 38 mm (1.5 in.) from the bottom of the legs as shown in Figure 17b and Figure H. For chairs with casters, apply the load to the chair legs, but not more than 13 mm (0.5 in.) from the point of caster attachment (bottom of the leg). The loads shall be applied to the apparent weakest point (front-to-back) of the legs. Where the apparent weakest point is the front or rear edge of the leg, apply the load so that it is no greater than 25 mm (1.0 in.) from the edge.

### H.3.2 Test Procedure

a) A force of 334 N (75 lbf.) per leg shall be applied once to a front and rear leg simultaneously for one (1) minute.

d) Remove the force.

## H.4 Acceptance Level

There shall cause no loss of serviceability.

## Informative Appendix J – Figure of Leg-Base Chair

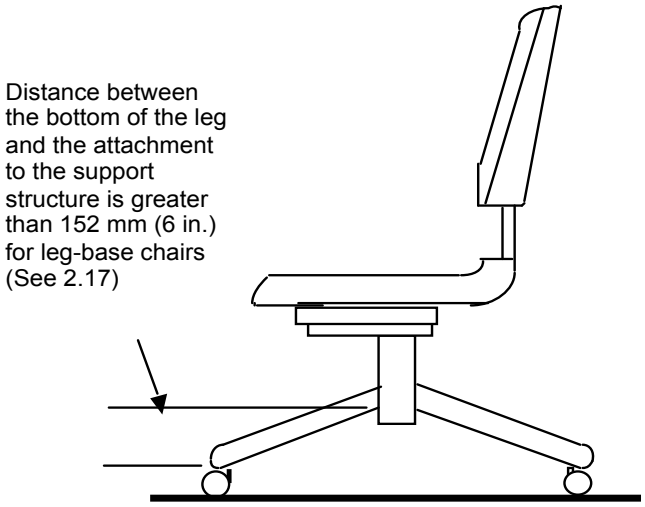



**Figure J – Leg-Base**

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