

Bariatric Beds: Performance and Dimensional Requirements - FIRA Standard FS060: 2019

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1.0 SCOPE

This FIRA Standard specifies test methods and requirements for safety, strength and durability performance requirements for the structural safety and stability of all types of bariatric beds and bed bases for contract and domestic use, by persons weighing between 150 kg to 250 kg (23.5 – 40 stone). The document also recommends dimensional requirements for bariatric beds.

It does not apply to waterbeds, airbeds, foldaway beds, bunk beds, or to beds for healthcare and medical purposes.

This document does not include requirements for the resistance to ageing, degradation, anti-bacterial/hygiene and flammability.

Other methods for the strength and durability of storage components, seating surfaces and other features associated with beds are covered by other standards.

Where a bed incorporates additional functions such as storage, electrical adjustability or conversion from a sofa to a bed, additional tests are applicable.

This document does not include requirements for the durability of upholstery materials, castors, and bed height adjustment mechanisms.

This document contains 3 Annexes:

- Annex A (informative) Recommended dimensional requirements
- Annex B (informative) Recommended design guidelines
- Annex C (informative) Rationale

2.0 NORMATIVE REFERENCES

The following referenced document was indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 19833: 2018 Furniture – Beds – Test methods for the determination of stability, strength and durability

BS EN ISO 845: 2009 Cellular plastics and rubbers – Determination of apparent density

BS EN ISO 2439: 2008 Flexible cellular polymeric materials – Determination of hardness (indentation technique)

3.0 TERMS AND DEFINITIONS

For the purposes of this document, the following terms and definitions apply:

3.1 Unframed slat base

Bed base consisting of separate slats flexibly held together normally by means of textile, rubber or plastic tape.

Note 1 to entry: When loading one slat, the load is transferred to the support by that slat only.

3.2 Framed base

Bed base consisting of slats, springs, etc., which are connected to a structural frame system.

Note 1 to entry: When loading one component only, e.g. a slat or a spring, the load is distributed by the frame to the support.

3.3 Framed sprung mattress

Upholstered bed base consisting of springs, topped with fillings, on a rigid frame to be used in a bed frame or freestanding.

3.4 Divan base

Upholstered bed base used without the need of any framework. It may be constructed with a spring filling or a solid top and may include drawers or storage facilities.

3.5 Accessible part

Part to which access can easily be gained by the user when the bed is in its intended configuration of use and for which the probability of unintentional user contact is high.

Note to entry: for beds the accessible zone is 120mm in from the sides and front of the bed. If any adjustment devices are outside of the accessible zone, they shall be considered to be part of the accessible zone, even though some contortion of the body may occur when reaching to make adjustments. Any area within a 50mm radius of these devices shall also be considered as accessible.

3.6 Castor

Castor assembly comprising a housing, one or more wheels, an axle and, if required, accessories.

3.7 Part accessible during setting up and folding

Part to which access can only be gained when setting up and folding the furniture.

3.8 Shear and squeeze points

Shear and squeeze points exist if the distance between two accessible parts moving relatively to each other is less than 25mm and more than 8mm for adults, in any position during movement.

4.0 TEST EQUIPMENT

Unless otherwise stated all equipment shall be as described in the Clause 5 (Test Apparatus) of ISO 19833:2018.

5.0 TOLERANCES

Unless otherwise stated, the following tolerances apply:

- All forces shall have an accuracy of $\pm 5\%$ of the nominal force
- All masses shall have an accuracy of $\pm 1\%$ of the nominal mass
- Dimensions $\leq 300\text{mm}$ shall have an accuracy of $\pm 1\text{ mm}$
- Dimensions $>300\text{mm}$ shall have an accuracy of $\pm 0.5\%$ of the nominal dimension
- All angles shall have an accuracy of $\pm 2^\circ$
- The positioning of loading pads shall have an accuracy of $\pm 5\text{ mm}$

Note: For the purposes of uncertainty measurement test results are not considered to be dversely affected when the above tolerances are met.

6.0 GENERAL TEST CONDITIONS

General test conditions shall be as described in clauses 4.1 and 4.2 of ISO 19833:2018.

7.0 GENERAL SAFETY REQUIREMENTS

7.1 General safety requirements

The item of bed shall be designed to minimise the risk of injury to the user.

All components or parts of the bed, with which the user can come into contact during normal use, shall not have burrs and/or sharp edges.

In order to avoid pinching points for feet, safety height of units moving vertically shall be at least 100mm from the floor.

Movable and adjustable parts shall be designed so that injuries and inadvertent operation are avoided.

It shall not be possible for any load bearing part of the bed to come loose unintentionally.

7.2 Shear and squeeze points

7.2.1 Shear and squeeze points when setting up and folding

Unless 7.2.2 or 7.2.3 are applicable, shear and squeeze points that are created only during setting up and folding, including tipping seat actions, are acceptable, because the user can be assumed to be in control of his/her movements and to be able to cease applying the force immediately upon experiencing pain.

The edges of parts moving relative to each other and creating shear and squeeze points shall be as specified in 7.1.

7.2.2 Shear and squeeze points under influence of powered mechanism

With the exception of tipping seats there shall be no shear and squeeze points created by parts of the seating operated by powered mechanisms, e.g. springs and gas lifts.

7.2.3 Shear and squeeze points during use

There shall be no shear and squeeze points created by forces applied during normal use.

Note: The forces applied during durability testing are considered forces applied during normal use.

7.2.4 Tubular components

There shall be no accessible holes in the ends of tubular component with a diameter between 7mm and 12mm with a depth more or equal to 10mm.

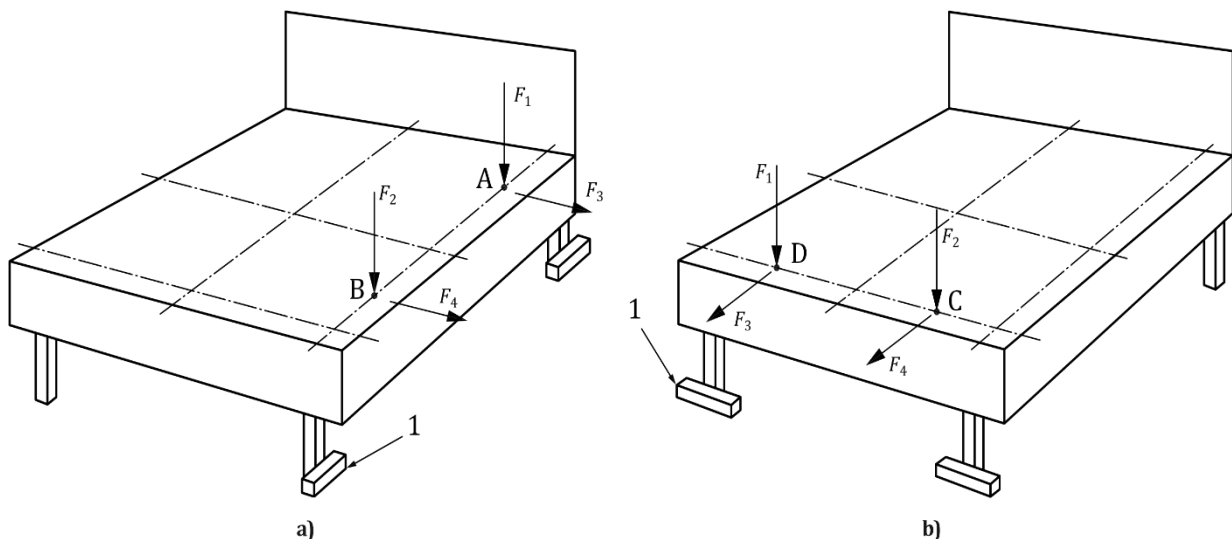
8. STABILITY

8.1 Stability Test

Position the bed on the floor surface with the legs or base restrained by stops. See Figure 1 a) and Figure 1 b).

Apply two downward forces F_1 and F_2 simultaneously by means of the small loading pad (clause 5.4 of ISO 19883: 2018) at point A and point B, 60mm behind the front edge of the bed sides; see Figure 2. At each loaded position, apply two outward forces F_3 and F_4 (as specified in Table 1) simultaneously for at least 5 seconds along a horizontal line extended forward from the point where the base of the loading pad meets the upper surface of the bed side/bed frame. If the construction of the bed is symmetrical in width direction, perform the test at one side only.

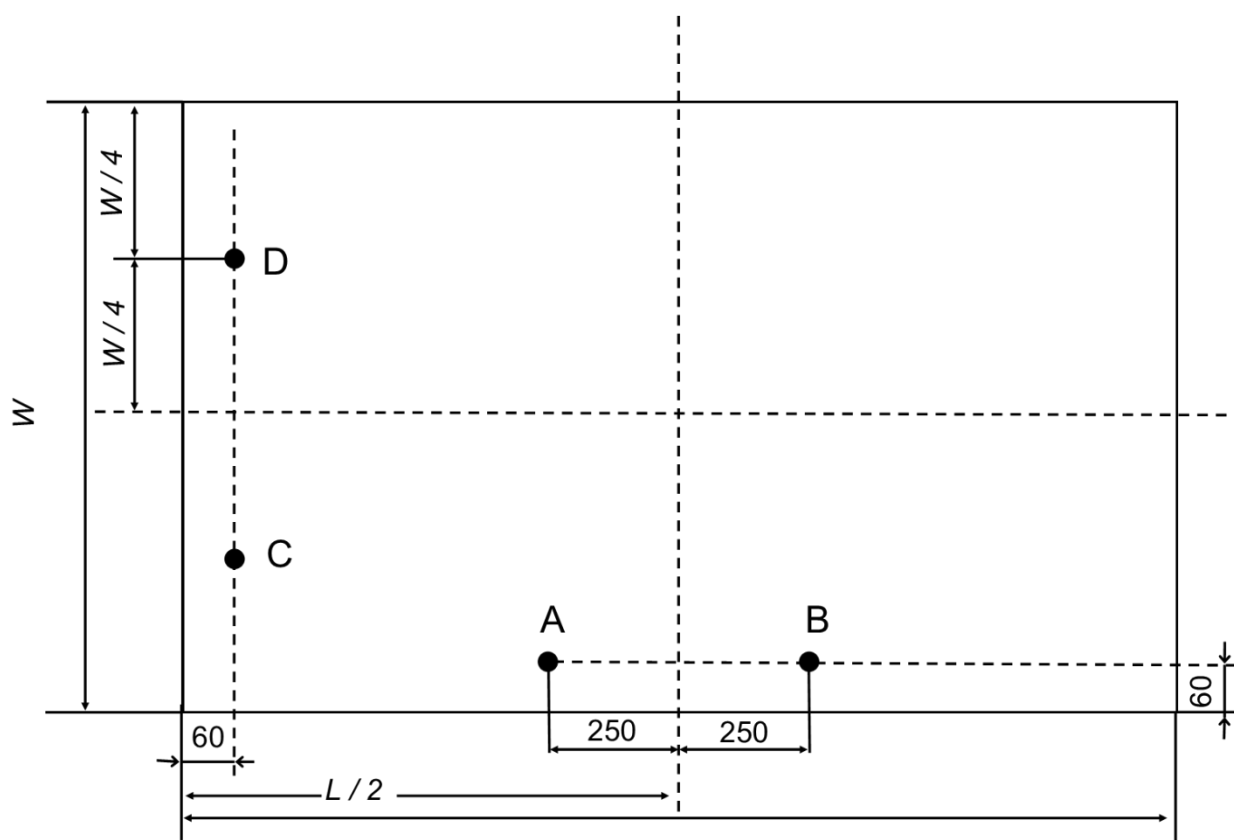
Figure 1: Stability test



Key

- 1 stop
- F_1, F_2 downward force
- F_3, F_4 outward force
- A, B, C, D force loading points

Figure 2 Vertical loading points of stability test

**Key**

L length of bed base

W width of bed base

A, B, C, D force loading points

8.2 Stability requirement

When tested according to 8.1 and by using forces specified in Table 1, the test unit shall not overturn.

Table 1: Stability test – Specified forces

Forces	F_1	F_2	F_3	F_4
Newtons	1250	1250	50	50

9.0 STRENGTH AND DURABILITY REQUIREMENTS

9.1 General

Unless otherwise specified, the test shall be carried out in the configuration most likely to cause failure.

When the mattress, bed base and frame (if applicable) are supplied together as a bed set, they shall be tested together.

When other components are supplied separately, they shall be tested using the test mattress, test support or test bed base as described in Clause 5 of ISO 19833: 2018, unless otherwise specified by the manufacturer of the components under test.

Table 2 shows which tests are applicable to a bed set and which to parts of a bed.

Table 2: Testing of beds, bed frames and bed bases

Test	9.2.1	9.2.2	9.2.3	9.2.4	9.3.1	9.3.2	9.4
Complete bed	✓	✓	✓	✓	✓	✓	-
Bed base	✓	(✓)	(✓)	✓	(✓)	✓	✓
Bed frame	✓	✓	✓	(✓)	✓	(✓)	-

(✓) = if applicable

✓ = test to be carried out

9.2 Strength tests

9.2.1 Vertical static load test

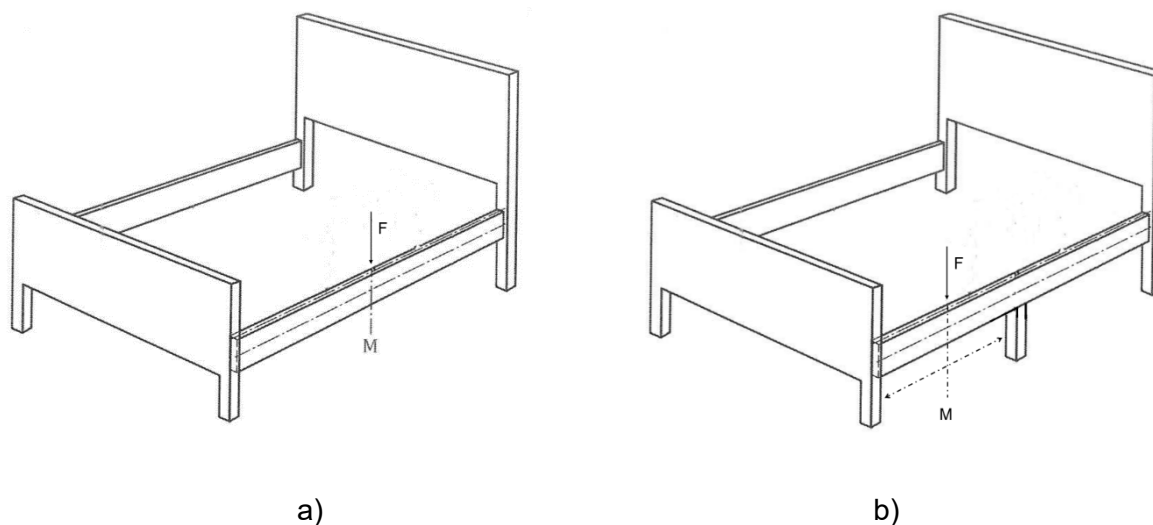
Apply a vertical force of 3000 N downwards using the loading pad (clause 5.3 of ISO 19883: 2018). Apply the load 10 times at any point of the bed base where failure is most likely to occur, but not less than 100mm from any edge. If there are such several positions, carry out the test only at the most adverse positions.

9.2.2. Vertical static load test of the edge of the bed

Using the small loading pads (clause 5.4 of ISO 19883: 2018) apply a force of 3000 N for 2 minutes. The load shall be applied at the mid-point between the side legs of the bed frame (see Figure 3a). If there are more than two legs apply the load at the midpoint of the two legs with the longest span. See Figure 3b).

During the test if the bed tends to overturn, bed shall be load sufficiently to prevent it from overturning.

Figure 3 Vertical static load on the edge of the bed



Key

F vertical static force

M middle point line of the side rail

9.2.3 Horizontal static load tests for headboards

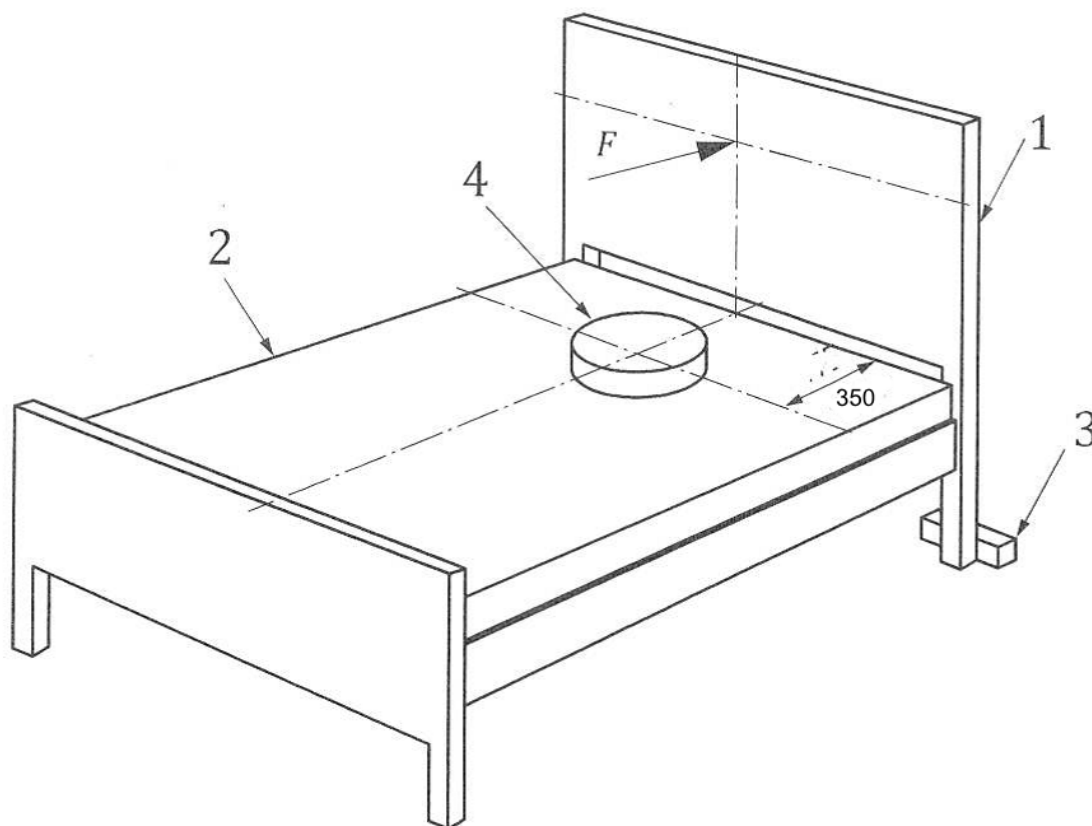
This test only applies to beds with headboards or equivalent structures which are designed to be leant against by users.

This test is not applicable to beds without headboards or whose headboard's upper edge is less than 300 mm high from the upper surface of the bed base.

Place the stops behind the legs/base to prevent the bed from moving during the test

Place a mass of 250kg on the centre line of the bed base, 350mm from the headboard. Apply the outward force of 750 N using the loading pad (clause 5.3 of ISO 19883: 2018). The loading point shall be at 600mm above the upper surface of the bed base or at a point 100mm below the upper edge of the headboard, whichever is the lower. The loading point shall be at the centre line of the headboard (see Figure 4).

Figure 4: Horizontal static load on headboard of beds



Key

- 1 headboard
- 2 mattress
- 3 stop
- 4 mass
- F horizontal outward force

9.2.4 Horizontal static load tests for beds without headboards

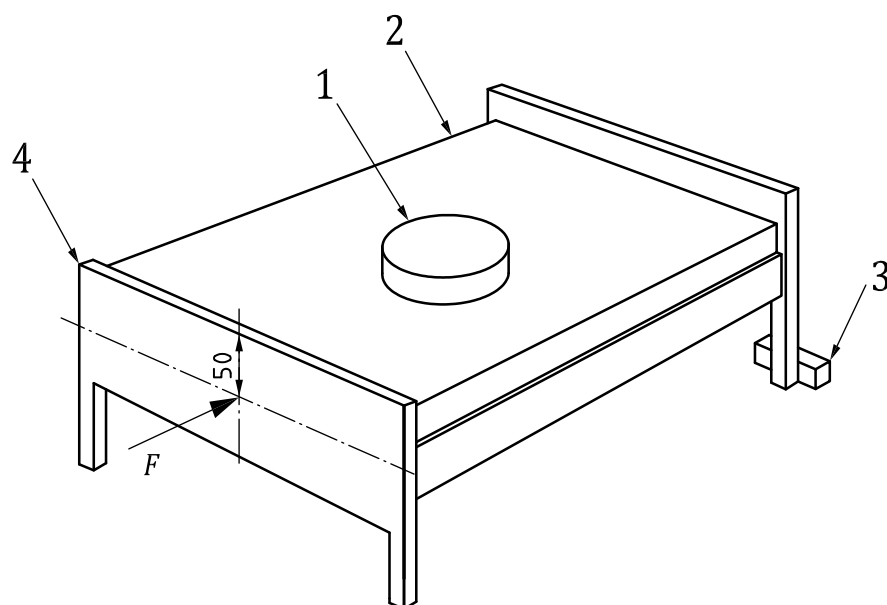
This test applies to the beds without headboards or whose headboard's upper edge is less than 300mm high from the upper surface of the bed base.

Place the stops behind the legs/base to prevent the bed from moving during the test.

Place a mass of 250kg on the centre of the bed base.

Apply the horizontal force of 750 N using the loading pad (clause 5.3 of ISO 19883: 2018). The loading point shall be at the centre line of the end member, 50mm below the upper edge of the end member which is furthest away from the stops. See Figure 5.

Figure 5: Horizontal static load test for beds without headboards



Key

- 1 test mass
- 2 mattress
- 3 stop
- 4 end member
- F horizontal force

9.3. Durability tests

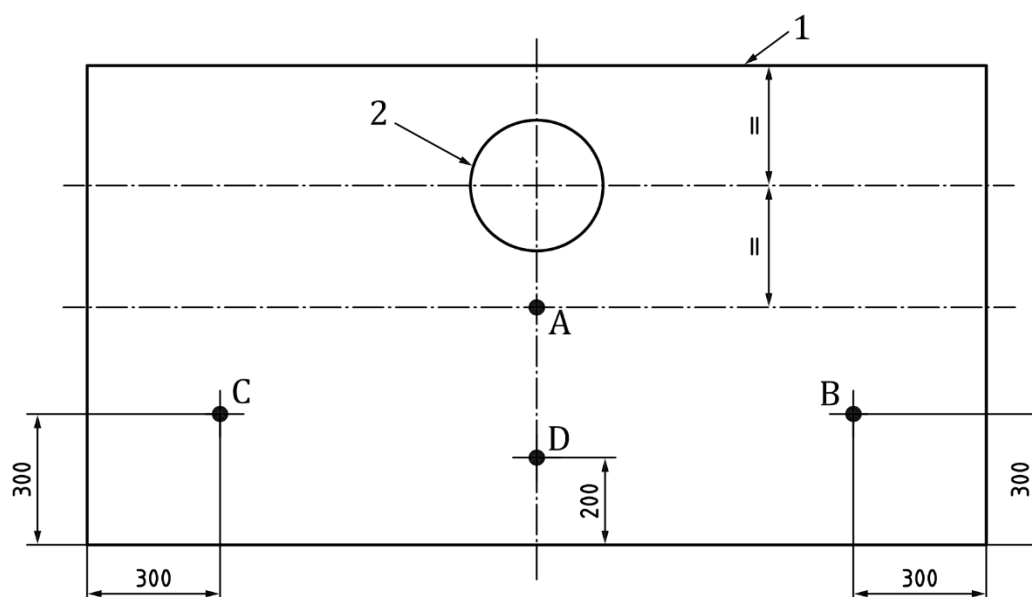
9.3.1 Vertical durability of bed base

Apply the vertical downward force of 3000 N for 5000 cycles by using the loading pad (clause 5.3 of ISO 19883: 2018) at each position as follows (see Figure 6):

- a) centre of the bed base (point A)
- b) point 300 mm from the adjacent edges (point B)
- c) point opposite of B (point C)
- d) point on the transverse centreline, 200mm from the long edge (point D)

In the case where the supporting structure of head and feet is identical, the test shall be performed in the middle and to one end only.

Figure 6 Vertical durability test of bed base



Key

- 1 bed base
- 2 test mass
- A, B, C, D force application points

If the bed tends to overturn, load the bed base on the opposite side to point D gradually to prevent overturning.

9.3.2. Horizontal durability test of bed frame

When the bed is supplied without a mattress, position the mass of 50kg at the centre of the bed base.

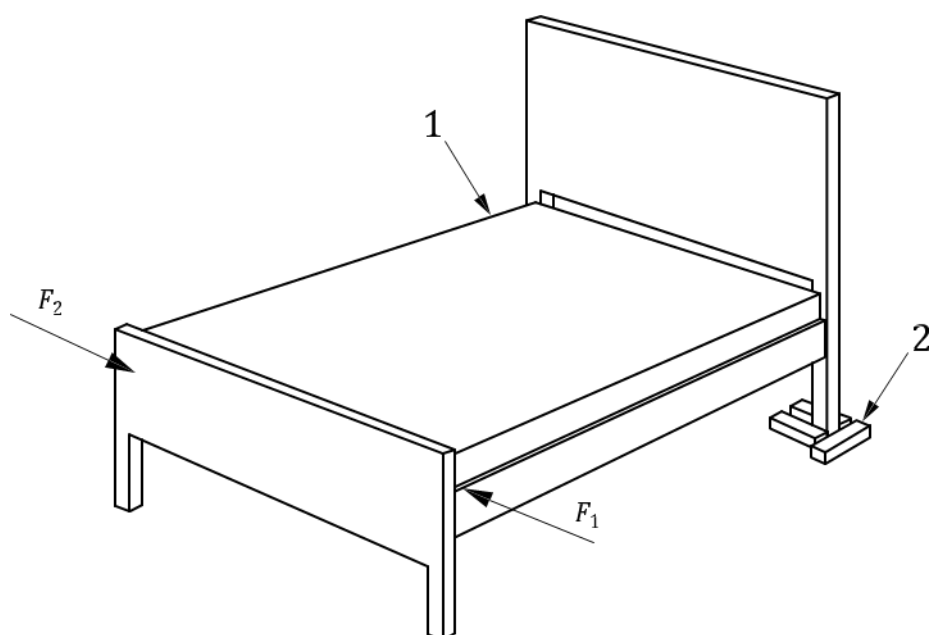
Place stops around the legs or base at one end. If there is a headboard, place the stops at that end (see Figures 7 and 8).

Apply two horizontal forces F1 (150 N) and F2 (150) alternately for 10,000 cycles by means of the small loading pad (clause 5.4 of ISO19883: 2018) at the unrestrained bed end and perpendicular to the longitudinal axis of the side rail. See Figures 7 and 8.

The loading points shall be at the height of the upper surface of the bed base, 100mm inboard from the outside plane of the end member (see Figure 8).

One application of the force in each direction represents one cycle.

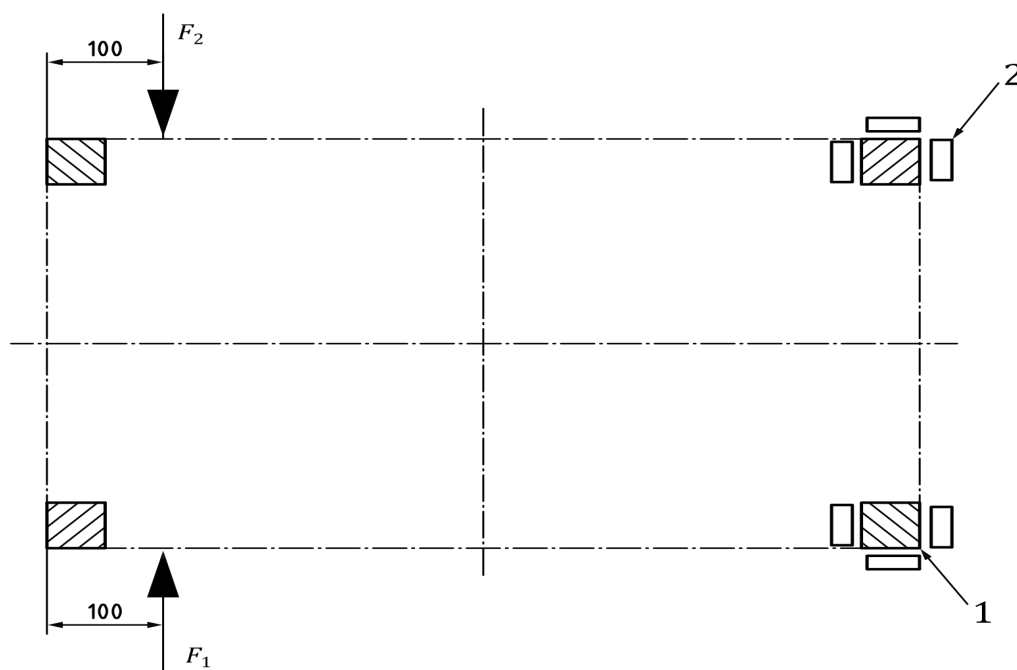
Figure 7: Horizontal durability test of bed frame



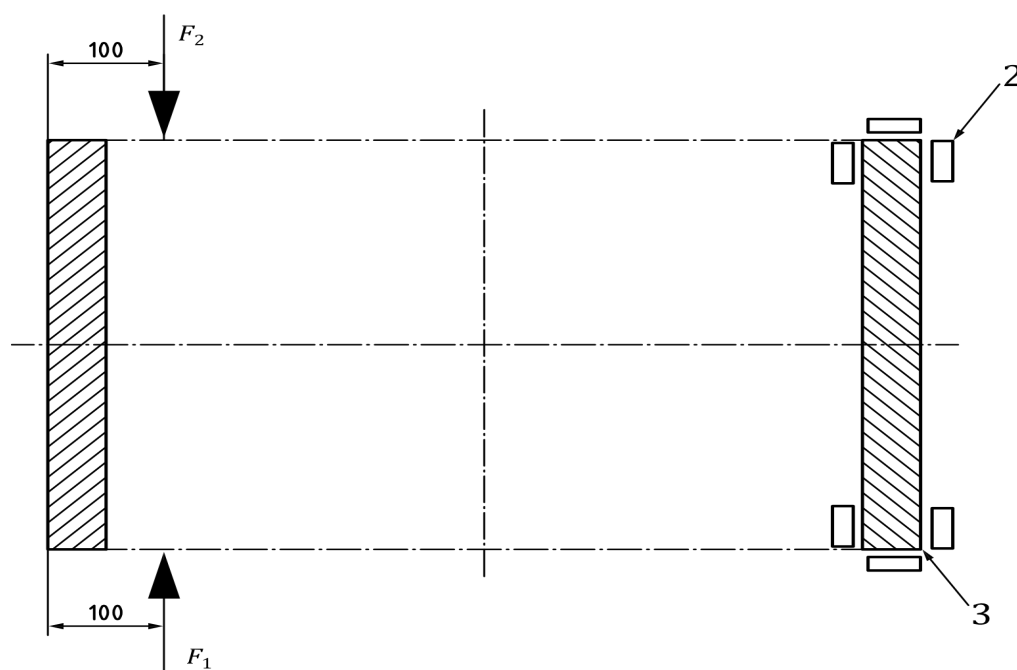
Key

1	mattress
2	stop
F_1 , F_2	horizontal forces

Figure 8: Horizontal durability test of bed frame — Force application points and directions



a) Example — Bed with feet



b) Example — Bed with panel ends

Key

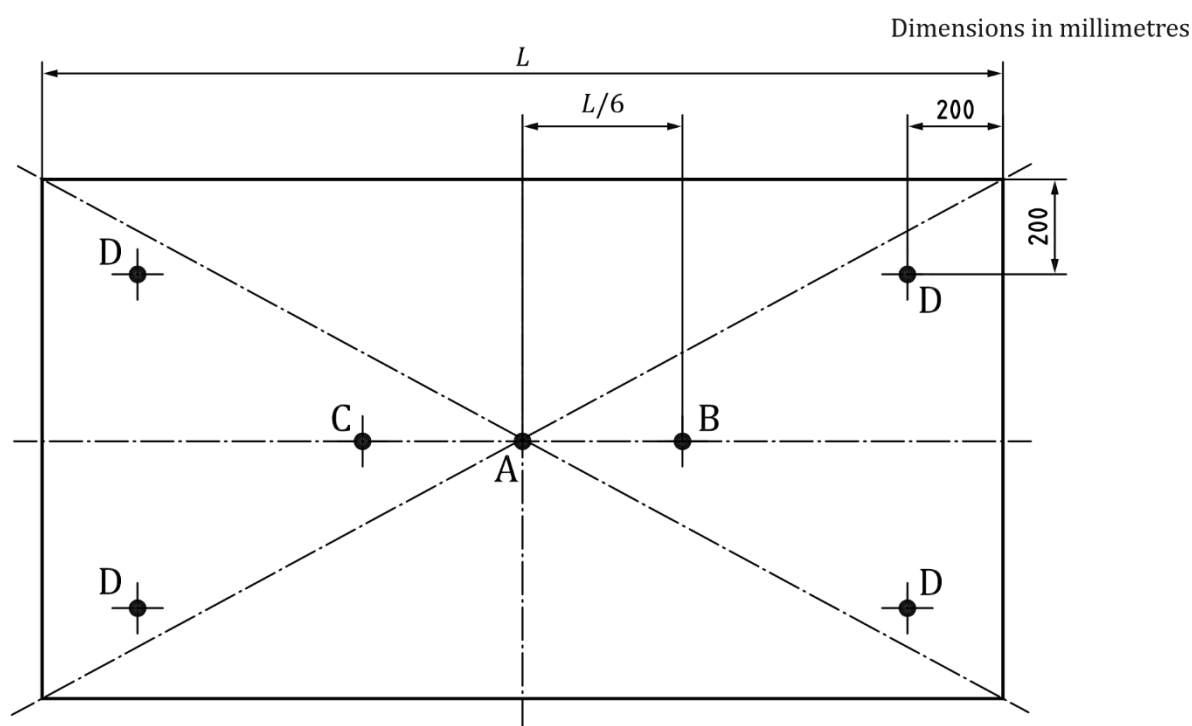
1	leg
2	stop
3	panel end
F1, F2	horizontal forces

9.4 Vertical impact test

The impactor (clause 5.6 of ISO 19883: 2018) shall be lifted to the height of 240mm (measured from the top face of the unloaded mattress). Let it drop freely onto the mattress, at the following positions (see Figure 9):

- centre of the bed base (point A)
- one third of the longitudinal axis from the middle (point B)
- point opposite of B (point C)
- point 200mm from the adjacent inside edges (point D)
- one other point of the bed base where failure is most likely to occur

Figure 9: Impact positions



Key

L	length of bed base
A,B,C,D	selected positions of impact

Drop the impactor 20 times at each of the selected positions of impact (see Figure 9). Each of the 4 selected D points in Figure 9 shall be impacted. The impactor shall be permitted to fall freely but may be guided by a guide rail.

9.5 Requirements for the strength, durability and impact tests

The strength and durability requirements are fulfilled when during and after testing in accordance with Table 2:

- a) There are no fractures of any member, joint or component
- b) There is no loosening of joints intended to be rigid
- c) No major structural element is significantly deformed
- d) The item fulfils its functions after removal of the test loads

The stability requirements are fulfilled when after testing in accordance with Table 1 the item does not overturn.

10. INFORMATION FOR USE

Information for use shall be available in the language of the country in which it will be delivered to the end user. It shall contain at least the following details:

- a) The weight range of the user for which the item of bed is designed
- b) If the item of bed is fitted with adjusting mechanisms: instruction for operating the adjusting mechanisms
- c) Assembly instructions, where applicable
- d) Instruction for the care and maintenance of the item of the bed

11. TEST REPORT

11.1 Test report cover sheet

The cover sheet of the test report shall contain at least the following information:

- a) the number and date of this Standard, i.e. FIRA FS 060: 2019
- b) unique reference of the item
- c) test result (either the words Pass or Comply for a successful result and Fail or Non-Comply for an unsuccessful result)

11.2 Test report contents

The test report shall contain at least the following information:

- a) the number and date of this Standard, i.e. FIRA FS 060: 2019
- b) unique reference of the item
- c) details of the article tested, e.g. specification and photographs
- d) details of any defects observed before the tests
- e) details of any defects and damage observed after the tests
- f) the test result
- g) name and address of test facility
- h) date of testing

ANNEX A (INFORMATIVE) – RECOMMENDED DIMENSIONAL REQUIREMENTS

A.1 Dimensional requirements

The body shape of bariatric users is unique to each individual user.

In the main such people find it difficult or impossible to get up from low heights. It is therefore, strongly recommended that the height from the floor to the top of the compressed mattress should be between 450mm and 500mm.

ANNEX B (INFORMATIVE) – RECOMMENDED DESIGN GUIDELINES

B.1 Filling materials

A firm foam is needed to spread the pressure of the user and provide the user a degree of comfort. A guide specification is a polyurethane foam is contained within Table B.1.

Table B.1: Sample foam specifications

Parameter	Units	Dimension	Method
Density	kg/m ³	65 - 70	BS EN ISO 845
Hardness	N	240 - 300	BS EN ISO 2439

In addition a visco-elastic foam topper can be used with the polyurethane foam to aid comfort. A guide specification is a polyurethane foam is contained within Table B.2.

Table B.2: Sample topper specifications

Parameter	Units	Dimension	Method
Density	kg/m ³	58 - 62	BS EN ISO 845
Hardness	N	100 - 130	BS EN ISO 2439

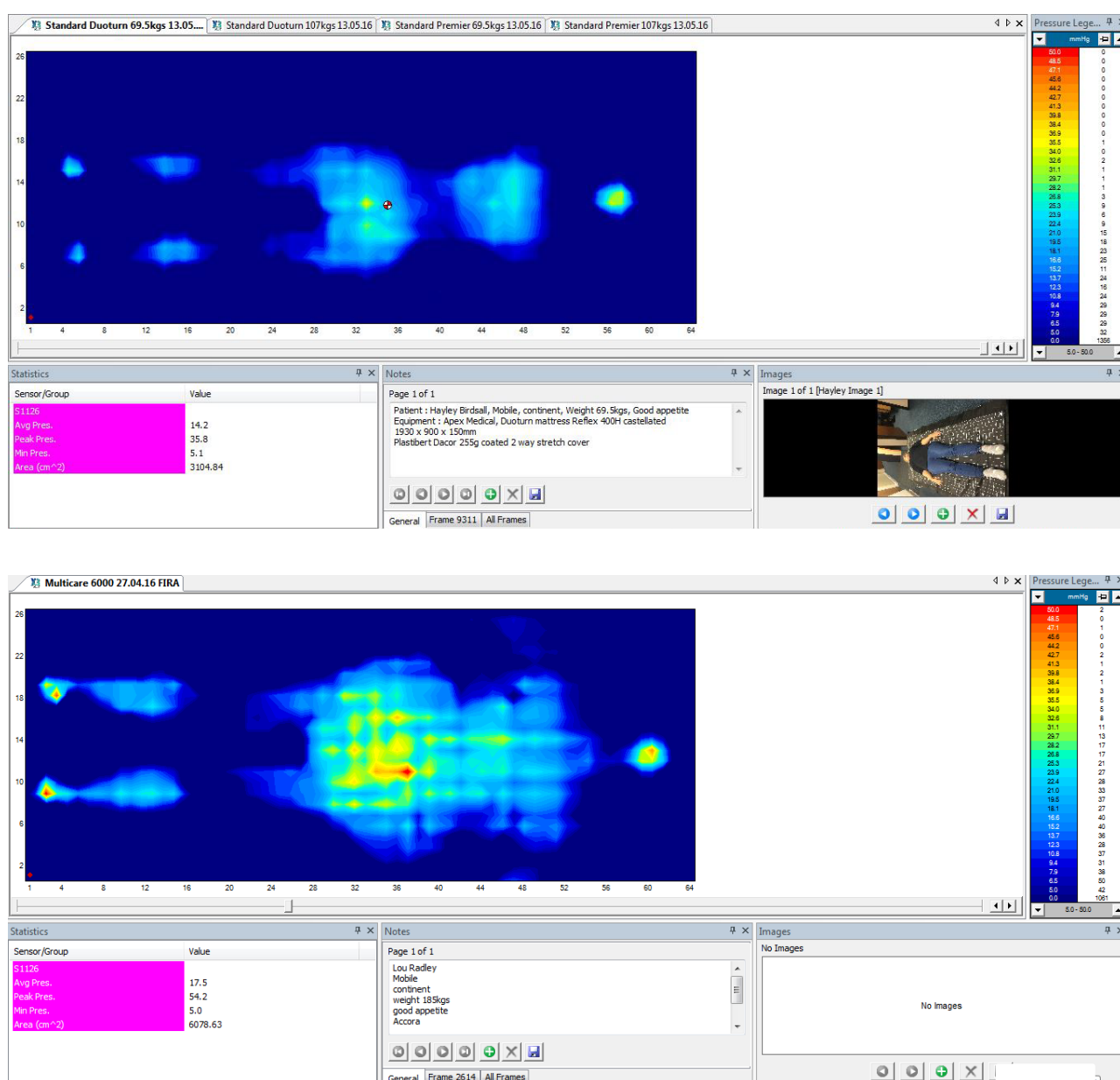
Additionally a high density silicone pad can also be used to help redistribute pressure and incorporate with either of the above fillings.

ANNEX C (INFORMATIVE) – RATIONALE

C.1 Rationale

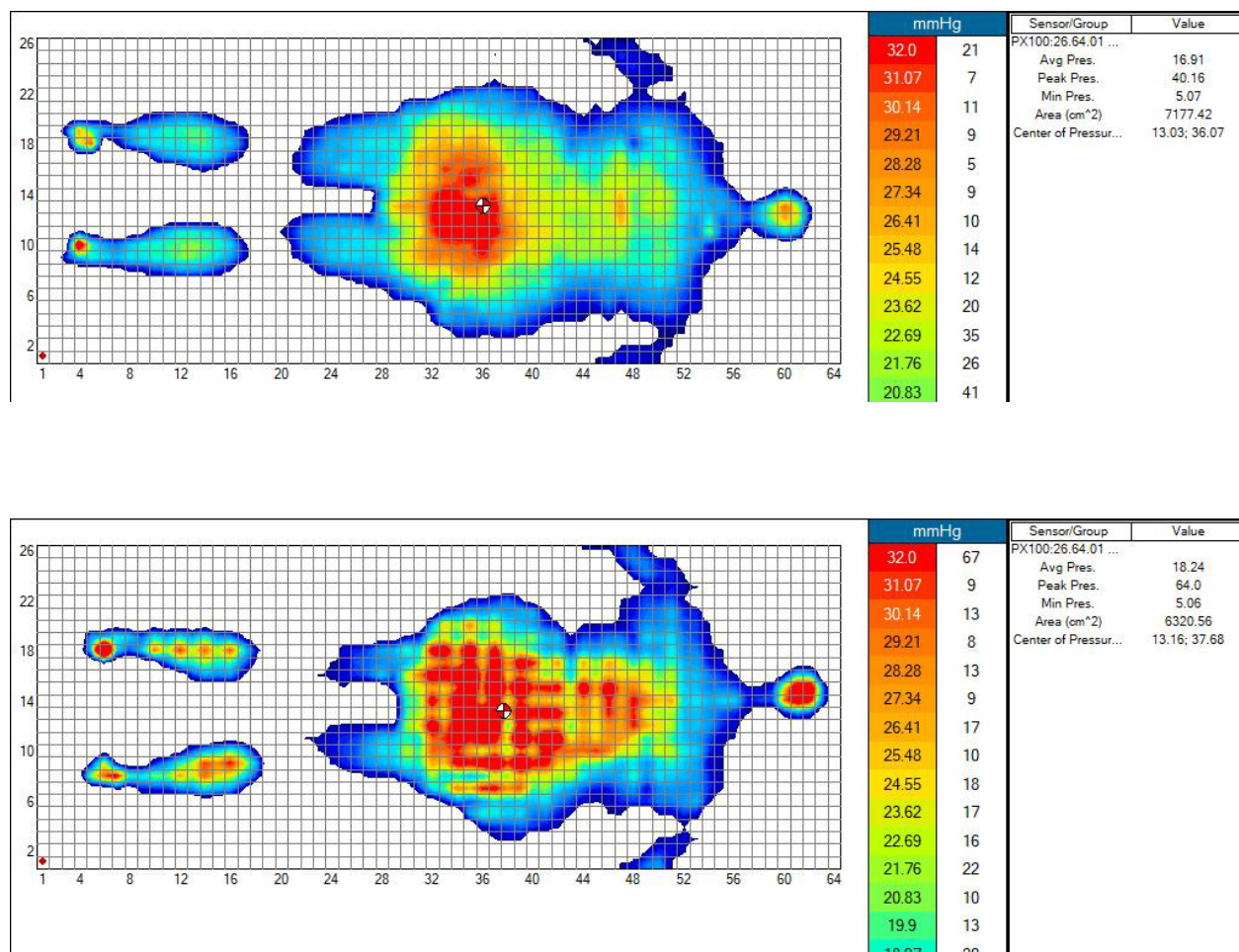
During the production of this standard research was carried out using both bariatric users and a review of available documents. Comparison of pressure mapping of bariatric and non-bariatric users helped to determine the position and the values of forces to be used in testing of bariatric mattresses. An example of comparative pressure mapping is shown below. This work also informed the rationale used in this document and is detailed below.

Figure C.1 Examples of pressure mapping



Further examples of pressure distribution and surface contact area by bariatric people are shown below.

Figure C.2 Additional pressure mapping examples



C.1.1 Loads

The loads defined in this standard have been increased from those detailed in the reference standards to reflect users whose body weight is in the region of 150kg to 300kg.

C.1.2 Cycles

Some of the cycles defined in this standard have been reduced from those detailed in the reference standards to reflect the fact that bariatric users can be less mobile and may remain in a bed for longer periods than non-bariatric users.

C.1.3 Loading points

C.1.3.1 Stability loading points

Stability loading positions are modified.

C.1.3.2 Strength and durability loading points

Strength and durability loading points have also been adjusted in line with the findings of study.

C.1.4 Dimensions

The dimensions recommended in the standard for bariatric beds were determined by using the following anthropometric data. Changes to the loading point were also based on the same data.

Bariatric size survey – Data

Tracey Carr, 2014

Moving and handling of plus sized people - illustrated guide

Mary Muir and Anita Rush
National Back Exchange, 2013



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