



BSI Standards Publication

Selection, placement and fixation of flexible postural support devices in seating – Specification

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Summary of pages

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Foreword

Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 October 2019. It was prepared by Subcommittee CH/173/1, *Wheelchairs* under the authority of Technical Committee CH/173, *Assistive products for persons with disability*. A list of organizations represented on this committee can be obtained on request to its secretary.

Information about this document

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Use of this document

It has been assumed in the preparation of this British Standard that the execution of its provisions will be entrusted to appropriately qualified and experienced people, for whose use it has been produced.

Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its requirements are expressed in sentences in which the principal auxiliary verb is “shall”.

Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

Contractual and legal considerations

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

Introduction

Postural support devices, such as positioning supports, have a specific purpose, which is to support an individual, to help maintain and increase day-to-day functionality for the individual, and to protect against the development of skeletal deformities, or to correct them. These devices, with their postural support purposes, are not to be confused with belts and similar devices designed to act as vehicular occupant restraints.

The records of MHRA (Medicines and Healthcare Products Regulatory Agency) show that over the last 15 years there have been four reported deaths and 17 serious injuries in the UK involving, or attributed to, pelvic postural support devices or anterior trunk postural support devices. These deaths are thought to have occurred as a result of inappropriate placement, adjustment or failure of the supports. There appears to be confusion as to best practice, and the reasons why postural supports need to be placed and adjusted according to the occupant's needs.

The MHRA originally provided guidance in the UK on the placement of pelvic positioning supports, but the advice was in effect more appropriate for wheelchair tie down and occupant restraint systems, rather than positioning supports. This advice was updated in 2015 in MDA/2015/018 [1]. This new guidance places the onus on the manufacturer or equipment prescriber to decide what might be best for an individual; although with minimal guidance on how this is to be ensured. This introduced the risk of a variety of interpretations, which might not be consistent, and which could cause further confusion.

For this reason, this British Standard has been produced to specify the selection and placement of positioning supports when used in seating systems and chairs, including wheelchairs and bathroom equipment (such as shower chairs) and, where applicable, hoists. This standard has been created for use by clinicians, engineers, carers, manufacturers, retailers and repairers.

NOTE 1 In this document, nomenclature has been based on BS ISO 7176-26 and ISO 16840-1. Thus, a support described as a positioning support might have the name adapted to include a description of its function based on the part of the body to which it is applied: e.g. a pelvic positioning support helps to position the pelvis, but might not be applied directly to the pelvis. However, an anterior pelvic support would be applied anterior to the pelvis.

NOTE 2 Positioning support placement can differ based on clinical and risk assessment.

1 Scope

This British Standard specifies requirements for the selection, placement and fixation of flexible postural support devices within seating devices and systems, and to chairs, including wheelchairs and bathroom equipment. Seating devices can be involved in one or more situations, including static seating, wheelchair seating, shower chairs, etc. The devices enable the seated person (the occupant) to be positioned to maximize their functional activities and to do so in a safe environment. These requirements have a balance of maintenance of posture and of safety.

This British Standard covers flexible positioning supports (padded or otherwise) used for postural positioning and/or safety. It does not cover belts and harnesses used in transportation for restraint, nor postural support devices made from rigid materials such as metal, wood or hard plastics, nor postural support devices designed solely for use in sports-related seating.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document.¹ For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS ISO 7176-16, *Wheelchairs – Part 16: Resistance to ignition of postural support devices*

BS ISO 7176-26, *Wheelchairs – Part 26: Vocabulary*²

BS ISO 16840-3, *Wheelchair seating – Part 3: Determination of static, impact and repetitive load strengths for postural support devices*

BS ISO 16840-10:2014+A1:2018, *Wheelchair seating – Resistance to ignition of non-integrated seat and back support cushions – Part 10: Requirements and test methods*

ISO 16840-1, *Wheelchair seating – Part 1: Vocabulary, reference axis convention and measures for body segments, posture and postural support surfaces*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS ISO 7176-26, ISO 16840-1 and the following apply.

3.1.1 anterior support

postural support device intended to contact the anterior surface of a body segment

[SOURCE: BS ISO 7176-26:2007, 4.7.23]

NOTE 1 Examples of anterior support are anterior head support, anterior lower leg support, anterior pelvic support, anterior shoulder support, anterior trunk support and anterior upper arm support.

NOTE 2 The following are deprecated terms: anterior head strap, forehead strap, forehead support, headband, knee block, knee strap, lap belt, pelvic stabilizer, pelvic strap, safety belt, seat belt, subaxis bar, backpack strap, shoulder bar, shoulder hook, shoulder retractor, shoulder strap, anterior thoracic support, butterfly strap, butterfly harness, chest harness, chest strap, H-strap, harness, spiderman strap, Y-strap, humeral strap.

3.1.2 circumferential support

postural support device which supports a body segment on at least three sides from at least three directions

[SOURCE: BS ISO 7176-26:2007, 4.7.29]

NOTE 1 Examples of circumferential support are circumferential ankle support, circumferential chest support, circumferential neck support and circumferential wrist support.

NOTE 2 The following are deprecated terms: ankle strap, cervical collar, circumferential cervical support, collar, Houdini strap.

¹ Documents that are referred to solely in an informative manner are listed in the Bibliography.

² This British Standard also gives informative references to BS ISO 7176-26:2007.

3.1.3 flexible postural support device

postural support device that is capable of conforming to the shape of the anatomy when applied to the occupant

NOTE 1 This includes any component of the flexible postural support device which can in itself be non-flexible, such as a frame mount or adjustment buckle.

NOTE 2 A flexible postural support device is also referred to in this British Standard as a flexible PSD.

3.1.4 inferior support

postural support device intended to contact the inferior surface of a body segment

NOTE 1 An inferior support usually applies to the buttocks and thighs, and is used with or as part of a seat cushion.

[SOURCE: BS ISO 7176-26:2007, 4.7.28]

NOTE 2 Examples of inferior support are inferior lower leg support, inferior pelvic support and inferior upper leg support.

NOTE 3 The following are deprecated terms: stump support, obliquity pad, thigh wedge.

3.1.5 lateral support

postural support device intended to contact the lateral surface of a body segment

[SOURCE: BS ISO 7176-26:2007, 4.7.26]

NOTE 1 Examples of lateral support are lateral head support, lateral knee support, lateral lower leg support, lateral pelvic support, lateral trunk support, lateral upper arm support and lateral upper leg support.

NOTE 2 The following are deprecated terms: head side support, lateral headrest, adductor pad, adductor strap, calf strap, calf support, leg block, leg guide, leg pad, leg strap, leg rest pad, hip block, hip guide, hip pad, lateral hip support, body side support, lateral, lateral support, lateral pad, lateral thoracic pad, lateral thoracic support, scoliosis pad, side cushion, trunk pad, humeral block, protractor, adductor pad, adductor wedge, lateral thigh support, leg block, leg pad, leg strap, thigh block, thigh strap.

3.1.6 linear support surface measures

NOTE Where the support's local axis is referred to, the axis system is that used in A clinical application guide to standardized wheelchair seating measures of the body and seating support surfaces [2].

3.1.6.1 depth

linear dimension of a support surface measured along or parallel to the support's local X-axis

NOTE This is the measure from the back to the front of the item.

3.1.6.2 length

linear dimension of a support surface measured along or parallel to the support's local vertical Y-axis

NOTE Length can also be referred to as vertical length.

3.1.6.3 thickness

dimension measured perpendicular to the support surface reference plane

3.1.6.4 width

linear dimension of a support surface measured along or parallel to the support's local Z-axis

NOTE This is the measure from one lateral side to the other.

3.1.7 medial support

postural support device intended to contact the medial surface of a body segment

[SOURCE: BS ISO 7176-26:2007, 4.7.25]

NOTE 1 Examples of medical support are medical knee support, medical lower leg support and medical upper leg support.

NOTE 2 The following are deprecated terms: pommel, adduction strap, adductor pad, adductor wedge, leg adductor support, leg dividing support, wedge, wedge pad.

3.1.8 occupant

person supported by the wheelchair seating system

[SOURCE: BS ISO 7176-26:2007, 4.2.2]

NOTE The following is a deprecated term: user.

3.1.9 posterior support

postural support device intended to contact the posterior surface of a body segment

[SOURCE: BS ISO 7176-26:2007, 4.7.24]

NOTE 1 Examples of posterior support are posterior foot support, posterior head support, posterior lower leg support, posterior lumbar support, posterior sacral support and posterior upper arm support.

NOTE 2 The following are deprecated terms: heel cup, heel loop, heel strap, calf pad, calf panel, calf strap, calf support, leg strap, leg support, leg rest pad, lower leg support, posterior leg support, lower leg support, lumbar pad, lumbar roll, posterior pelvic support, elbow block, humeral block, protractor.

3.1.10 postural support device (PSD)

structure, attached to a seat or wheelchair, which has a surface that contacts the occupant's body and is used either to support, correct or stabilize the occupant's sitting posture

[SOURCE: BS ISO 7176-26:2007, 4.7.3, modified]

NOTE 1 The structure of the terms is such that they describe the application rather than the construction of each device. Therefore, both flexible and non-flexible solutions are included in the deprecated terms given in the notes to the definitions.

NOTE 2 Postural support device is also referred to in this British Standard as positioning support or postural support.

3.1.11 restraints

3.1.11.1 restraint

measure or condition that keeps someone or something under control

3.1.11.2 occupant restraint

system or device intended to restrain a motor-vehicle occupant during an impact in order to prevent ejection, and prevent or minimize contact with the vehicle interior components and other occupants

NOTE Securement points may be located on hardware components that are permanently or temporarily fastened to a wheelchair.

[SOURCE: BS ISO 7176-26:2007, 4.11.16]

3.1.11.3 protective restraint

device, including, but not limited to, a wristlet, anklet, vest, mitt, straight jacket, body/limb holder, or other type of strap that is intended for medical purposes and that limits the occupant's movements to the extent necessary for treatment, examination or protection of the occupant or others

[SOURCE: FDA Code of Federal Regulations Title 21 [3], modified]

3.1.12 superior support

postural support device intended to contact the superior surface of a body segment

[SOURCE: BS ISO 7176-26:2007, 4.7.27]

NOTE 1 Examples of superior support are superior foot support, superior lower arm support and superior upper leg support.

NOTE 2 The following are deprecated terms: toe cup, toe loop, forearm hook, forearm strap, leg strap, thigh strap.

3.2 Abbreviations

For the purpose of this British Standard, the following abbreviations apply.

ASIS	anterior superior iliac spine
PEG	percutaneous endoscopic gastrostomy
PSIS	posterior superior iliac spine

4 Aims and principles of application of flexible PSDs

COMMENTARY ON CLAUSE 4

Flexible PSDs are designed to increase sitting stability, maintain or correct posture, increase reach, enhance propulsion of the mobility device, or maintain a seated position for safety purposes. In many cases, the purpose of a flexible PSD can be a combination of all of these factors.

This might also apply to abdominal compression devices to improve exhalation which are attached to the seating system, but in this case, there might be safety considerations as to the effect on the device that a change in seated position might incur.

4.1 General

A flexible PSD shall be prescribed for stability when the primary purpose is to stabilize part of the body, in static or dynamic situations, to enhance function in other parts (e.g. to stabilize the lower body segments in order to increase the ability to reach outside the base of support or prevent forwards sliding, or to stabilize one arm for an occupant with dystonia to enable functioning of the other arm). This shall be achieved by restricting movement of the related body segment (e.g. using a pelvic postural support in conjunction with an anterior flexible trunk support to enable a powered wheelchair occupant to navigate uneven terrain safely).

NOTE 1 Where the occupant's posture is assessed to be flexible, a flexible PSD can be used in conjunction with other PSDs to improve postural alignment, reducing abnormal postures by applying a combination of corrective forces. In turn, this can reduce strain on joints and internal organs and help prevent further secondary complications (such as contractures, pressure injuries, respiratory complications, etc.) as well as increase comfort and function.

NOTE 2 Where the occupant's posture is assessed as being fixed, a flexible postural support device can be used in conjunction with other PSDs to support and maintain the optimal achievable and tolerable posture by applying a combination of maintaining forces. This can help prevent damaging posture from deteriorating further.

The occupant shall be assessed as to the correct style of PSD to be prescribed, and measured in accordance with [Annex A](#) so that the correct size of PSD is prescribed in accordance with [Annex B](#).

A flexible PSD shall be prescribed for safety when the primary purpose is to protect the occupant from injury (e.g. to prevent falling from the seat). This shall be achieved by limiting movement of one or more body segments.

Where the occupant is unable to remove the device independently, by consequence or design, a risk assessment shall be carried out to ascertain whether the device could be considered to be a restraint, prior to prescription (see [4.2](#) and [Annex C](#)).

Seating systems and chairs shall be supplied with space available to mount PSDs in the positions required by this British Standard.

4.2 Restraint versus positioning

COMMENTARY ON 4.2

Restraint is a term that has different meanings and connotations, depending on the context of use. For this reason, RESNA (Rehabilitation Engineering and Assistive Technology Society of North America) has produced a position paper to clarify the issue, in which the differences between supports and restraints are covered, as well as vehicular occupant restraints and protective restraints (see RESNA, 2013 [4]).

Positioning supports shall not be used with the primary purpose of restraint.

If a pelvic positioning support could be perceived as a restraint, the decision to use the support shall be made by an interdisciplinary team, including carers, with the justification documented. The justification shall show that appropriate thought was given to alternative interventions, including, but not limited to, contracture management, tone management and therapeutic intervention to address behavioural issues. Decisions shall, where practicable, be taken with the consent of the occupant, in the best interests of the occupant to ensure safety and function.

Any desired outcome resulting from the limitation of movement shall also be documented (e.g. to minimize the risk of falls). It shall also be documented where there is an aim to restrict movement in one part of the body, in order to facilitate greater function in another (e.g. fixation of the pelvis to improve postural stability).

Where positioning supports are determined as being the best method of postural management, a comprehensive clinical assessment shall be carried out demonstrating that the support is essential to achieve an appropriate postural position (see RESNA, 2013 [4]).

4.3 Safety

4.3.1 General

An assessment shall be carried out as to the health risks and benefits of the use of a PSD.

4.3.2 PSD-body interface

The risk to the occupant's skin integrity from where the PSD interfaces with the body shall be assessed and minimized.

4.3.3 Forces on bony prominences

The risk of increasing pressure from bony prominences such as the ischial tuberosities, ASISs, PSISs, iliac crests, sternum, etc. on the tissues covering these parts of the body shall be assessed and minimized.

4.3.4 Physiological function

The impact on breathing, digestive function, cardiovascular function, bladder function, etc. shall be assessed and optimized.

4.3.5 Ancillary medical devices

The positioning of PSDs shall not impede the positioning and function of catheters, pumps, or other ancillary medical devices.

4.3.6 Skeletal structure

The forces applied through the positioning of PSDs shall not create or lead to worsening of skeletal deformities.

4.4 Paediatric needs

4.4.1 General

The needs of a child with a developing skeleton and function means that the positioning of supports to accommodate growth and development requires particular attention and therefore shall be reviewed regularly.

NOTE The frequency of review depends on the age of the child, the child's rate of growth around that time and the rate of change of the causes for their need for supports.

4.4.2 Hip joint development

COMMENTARY ON 4.4.2

The hip joint, or acetabulofemoral joint, is the joint between the head of the femur and the acetabulum. Its primary function is to support the body's weight and aid balance in standing. The head of the femur and the acetabulum both rely on weight-bearing activities and walking in childhood, in order to develop. In a non-ambulatory child, the hip joint is under-developed, and is extremely vulnerable to dislocation. In individuals with cerebral palsy, in particular, hip subluxation or dislocation in teenagers can be common. In some cases, corrective surgery is required.

When applying a PSD, the impact of the applied force on the hip joint shall be taken into account.

EXAMPLE A medial (to lateral) strap (to encourage abduction) places an abducting/external rotation force on the hip. This might be painful when the hip is subluxed or dislocated.

NOTE 1 Even when a person has been previously ambulant, long-term disability causing weakness and muscle tone changes around the hip joint can increase the chance of hip dislocation. Changes in range of motion are also common.

A full physical assessment shall be carried out prior to prescription of a flexible PSD to understand fully the abilities and limitations in range of motion.

NOTE 2 Differentiating in particular between the hip range of motion and posterior pelvic tilt is critical for optimal positioning.

NOTE 3 Where the seat to back angle of the seat is too acute for the individual to tolerate, applying a postural support to hold the individual in that position is likely to be painful.

The natural angle of the femur is positioned at 5° of abduction from the midline; the cushion, and any medial and lateral thigh supports, shall facilitate this position unless the clinical seating assessment indicates an alternative position is required (e.g. to support a fixed deformity).

4.5 Materials

4.5.1 Testing

4.5.1.1 Static, impact and repetitive load strengths

PSDs shall be tested in accordance with the tests in BS ISO 16840-3 and shall pass the tests where there are pass/fail criteria.

4.5.1.2 Flammability

PSDs shall be tested in accordance with the flammability tests in BS ISO 7176-16 and BS ISO 16840-10:2014+A1, as appropriate.

NOTE BS ISO 7176-16 is a “match” flame test. BS ISO 16840-10:2014+A1, which covers non-integrated seat cushions and back supports, and is a virtual cigarette test, is being revised to cover all flexible PSDs.

4.5.2 Pressure distribution

Pressure distribution, e.g. by padding, surface contours or elastic fabrics, shall be provided where the PSD interacts with the occupant’s body in order to protect the occupant from harm from the PSD webbing materials (e.g. where it is in contact with bony prominences or where significant force is applied over soft tissues).

Pressure distribution elements shall be designed to follow the contours of the occupant’s body, and to dissipate evenly the forces of the support on the occupant’s body. The design shall not lead to curling of the padded support such that the forces no longer follow the contours of the occupant’s body. Where edging is applied to the pad to stop fraying of the pad, the edging material shall not provide a risk to the tissue integrity of the occupant, from wrinkling or other deformations, or from localized pressure points.

The dimensions of any webbing and padding (see [Annex A](#) and [Annex B](#)) shall be selected to meet the positioning needs of the occupant, taking into account the body mass of the part of the body to which the PSD is applied, and the forces needed to manage the occupant’s posture with that PSD.

4.5.3 Closure systems

4.5.3.1 General

Postural supports shall have a closure system (e.g. buckle, hook and loop) that allows the occupant to be released from the postural support when needed, but not accidentally. When tested in accordance with BS ISO 16840-3, the supports, in combination with the prescribed closure system, shall meet the pass criteria given therein. The type of closure system selected shall suit the occupant’s and/or the carer’s ability to open the buckle (see [Annex C](#) for further information).

Closure systems shall be selected and located such that they do not create a risk of harm to the occupant by digging into soft tissues (e.g. to the stomach or genitalia) or rubbing against bony prominences. Closure systems shall provide no risk of encroaching on moving parts of the wheelchair or seating system.

Where a hook and loop closure system is used, the hook side shall be positioned such that it is not in direct contact with the occupant, as it can cause skin irritation.

NOTE 1 Hook components in hook and loop closures risk being clogged up with extraneous materials, which can decrease their ability to attach to the loop component.

NOTE 2 Subclauses [4.5.3.2](#) to [4.5.3.6](#) list various types of closure systems which are commonly available, but this is not necessarily a comprehensive list.

4.5.3.2 Side release buckle

Side release buckles shall not be used with individuals with poor manual dexterity or strength, who need to release themselves from their support, as they require a relatively strong pinch action to release.

NOTE This can be achieved single-handedly.

4.5.3.3 Push button buckle

NOTE Push button buckles originate from the transport industry.

Where push button buckles are used, a buckle shall be selected with the appropriate spring strength, buckle tongue release and button size to meet the occupant and carer's needs.

4.5.3.4 Latch buckle

NOTE 1 Latch buckles are modelled on the buckles found in aircraft seat belts.

Latch buckles shall be used for occupants with limited manual dexterity who can exert a pull on the latch. Latch buckles shall be positioned such that they cannot be accidentally released by the occupant's elbow.

NOTE 2 This is more likely if the buckle has been placed off centre near the natural resting position for the elbow.

NOTE 3 Due to ease of operation, there might be a greater risk of accidental release.

4.5.3.5 Swivel buckle

Swivel buckles shall be used where a more dynamic relationship between the components of the support is required.

NOTE Swivel buckles are attached by a latching action, have a push release and allow the two components of the support to rotate relative to each other.

4.5.3.6 Security buckle

A security cover on a buckle, or a buckle with a design feature to limit access to the release mechanism, shall be used where the occupant would be placed at risk if they released the postural support.

NOTE 1 Examples of these are push-button buckles fitted with covers having a small aperture for accessing the release button, and side release buckles with a secondary sliding tab that blocks release.

The carer shall be able to release the buckle with, for example, a small pointed device.

NOTE 2 For restraint versus positioning considerations, see [4.2](#).

4.6 Transportation

COMMENTARY ON 4.6

It is important to be clear as to the difference between wheelchair postural supports and occupant restraint belts. The difference is evident in the descriptors: support versus restraint.

- *Wheelchair postural supports support a person's posture, or position in their wheelchair. These supports are not intended to be used for, nor do they have the required strength to be used as, occupant restraints during vehicle transport.*
- *Wheelchair occupant restraint belts are generic devices which are used to restrain a wheelchair occupant in the event of a vehicular collision.*

Where a postural support or other secondary support has been clinically prescribed, this is intended to assist in the corrective positioning of a wheelchair occupant who cannot independently maintain an optimal position in their wheelchair. In the absence of that postural support, the wheelchair occupant would probably adopt a sub-optimal posture. When this happens, it is difficult for the occupant restraint to be fitted in such a way that it makes contact with the wheelchair occupant in the manner in which it is designed to do, e.g. sub-ASIS, mid-sternal and mid-clavicle regions.