BRITISH STANDARD

BS EN
13200-5:2006

Spectator facilities —

Part 5: Telescopic stands

The European Standard EN 13200-5:2006 has the status of a British Standard

ICS 91.040.10; 97.200.10; 97.220.10

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National foreword

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A list of organizations represented on B/552 can be obtained on request to its secretary.

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Foreword

This document (EN 13200-5:2006) has been prepared by Technical Committee CEN/TC 315 “Spectator facilities”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2007, and conflicting national standards shall be withdrawn at the latest by February 2007.

The European Standard with the general title "Spectator facilities" is divided into six parts:

EN 13200-1:2003 Spectator facilities – Part 1: Layout criteria for spectator viewing area – Specification

CEN/TR 13200-2 Spectator facilities – Layout criteria of service area – Part 2: Characteristics and national situations

EN 13200-3 Spectator facilities – Part 3: Separating elements – Requirements

prEN 13200-4 Spectator facilities – Part 4: Seats – Product characteristics

EN 13200-5 Spectator facilities – Part 5: Telescopic stands

EN 13200-6 Spectator facilities – Part 6: Demountable (temporary) stands

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

This European Standard has been prepared in order to specify the general design criteria for spectator facilities (permanent, movable, demountable and telescopic), with the purpose of enabling their functionality.

Within this standard, minimum and recommended values for dimensions are occasionally presented. It should be recognised that these values are to be considered as values that, in part, recognise different national requirements as a basic provision.

Attention is drawn to the fact that in certain countries additional/different requirements may be applicable due to existing national regulations or the equivalent.

1 Scope

This European standard specifies product characteristics for telescopic stands at permanent or temporary entertainment venues including sports stadiums, sport halls and indoor and outdoor facilities. Stands in fairgrounds and amusement parks are excluded from this standard (see EN 13814).

2 Normative references

The following referenced documents are 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.

EN 1991-1-1, *Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings*

EN 12727, *Furniture - Ranked seating - Test methods and requirements for strength and durability*

EN 13200-1, *Spectator facilities - Part 1: Layout criteria for spectator viewing area - Specification*

prEN 13200-4, *Spectator facilities – Part 4: Seats – Product Characteristics*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1
chair (seat) spacing
lateral distance between the centres of adjacent chairs

3.2
client
person or organisation that requires a construction to be provided

3.3
dead load
load of a constant magnitude and position that acts permanently including self weight

3.4
designer
qualified person who designs the telescopic stand

3.5
design documentation
documents provided by the designer of telescopic seating that ensure that the basis of design may be clearly understood and from which all design criteria can be verified

3.6
event organiser
individuals or company managing the organisation of the event

3.7
guard rail
safety barrier fitted to the sides, rear or front of a grandstand or within the seating area in order to protect users from falling

3.8
half step
intermediate step or steps on an aisle or gangway, required when the row rise between seating platforms exceeds the allowable dimension

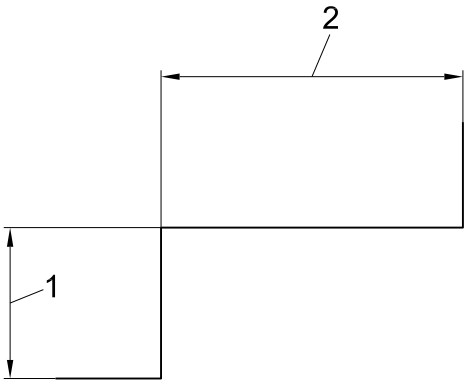
3.9
handrail
component designed to protect and assist the passage of users of the grandstand

3.10
imposed load
any load assumed to be produced by the intended occupancy, but excluding wind loads

3.11
load factor
factor by which the characteristic load is multiplied for design

3.12
manufacturer
supplier of the telescopic stands

3.13
riser
vertical component between one row and another row or the landing above or below it (see Figure 1)



Key

1 riser

2 row depth

Figure 1 — Riser

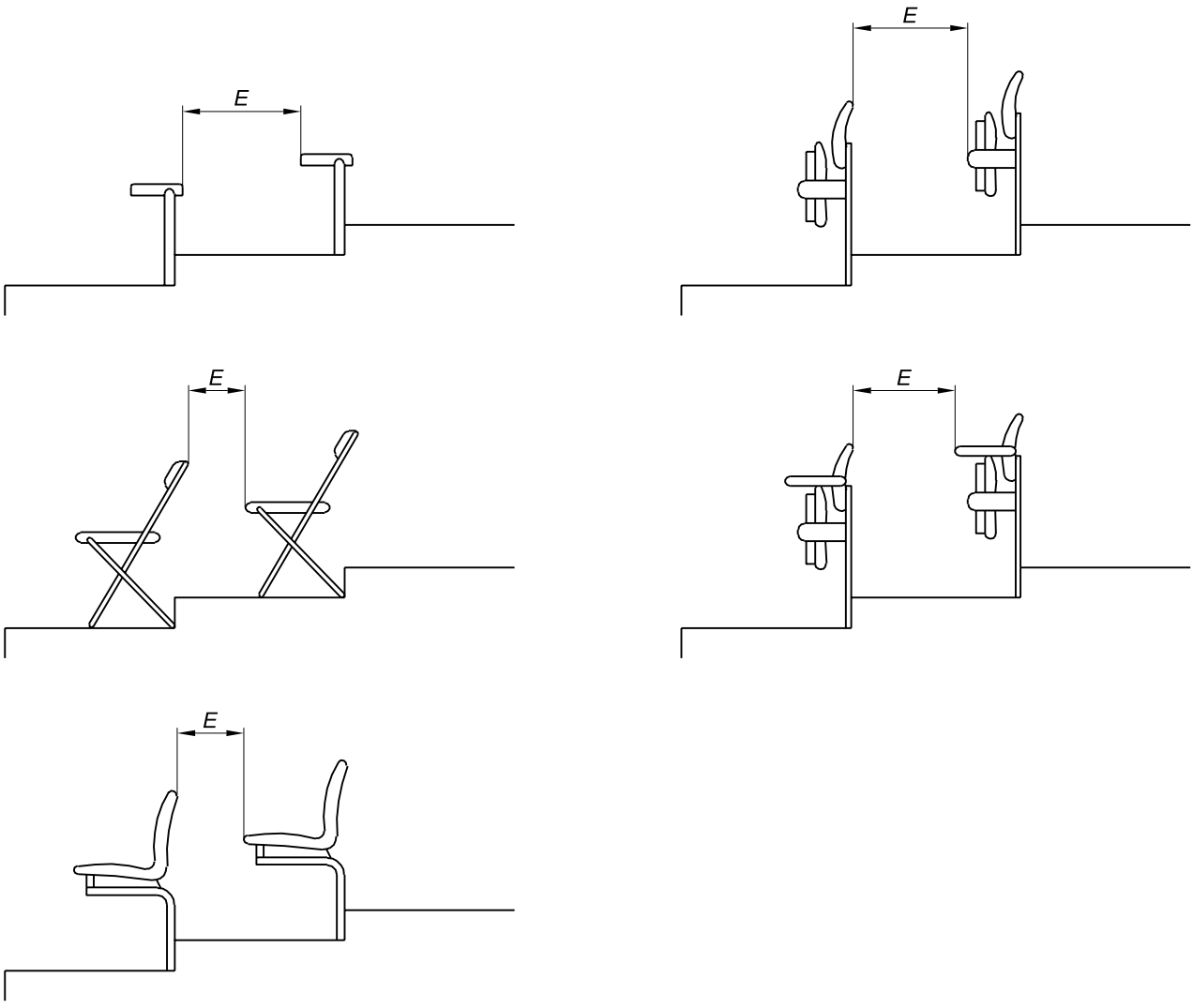
3.14
risk assessment
process by which the hazards associated with a given activity are identified

3.15
row depth
horizontal distance between successive risers (see Figure 1)

3.16
row rise
vertical distance between successive levels of seating or standing

3.17
seating unit
unit of telescopic seating within a seating block, comprising one set of an independent under-structure

3.18
seat-way
clearway
clear space measured at right angles between perpendiculars as shown in the following sketches. In all the following cases the minimum value of the seat-way 'E' is 350 mm and the recommended minimum value is 400 mm (see Figure 2)



Key

E Clearway

Figure 2 – Seat-way

3.19
stair
construction that comprises a succession of horizontal stages (steps or landings) that make it possible to pass on foot from one level to another

3.20
telescopic stand
stand constructed from standardised components or frames that opens and closes on wheels, castors or air film, converting a flat floor area into a tiered, spectator area

3.21
tread
horizontal component of a step

3.22
UDL
Uniformly Distributed Load

3.23
vomitory
access route built into the gradient of a stand which directly links spectator accommodation with routes for ingress, egress or emergency evacuation

3.24
wind load
load due to wind pressure

4 Materials requirements

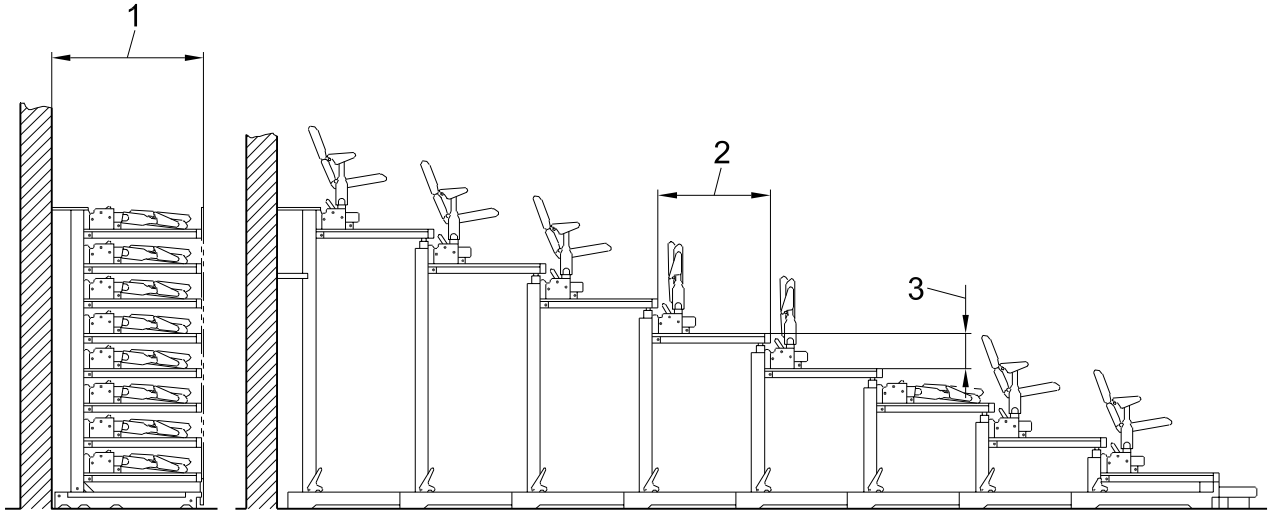
Telescopic stands are constructed from a range of materials including steel, aluminium, plywood, timber, paints and plastic components. Where materials, components and methods of design and construction are not specifically covered by CEN Standards, the designer should be satisfied that the materials and methods to be employed are such as to ensure sufficient levels of safety, durability, integrity, strength, serviceability and performance. Alternatively, a test assembly should be built to test the structure, component, material or method under consideration. The test assembly should be representative as to materials, workmanship and details of the design and construction for which approval is sought.

5 Design

5.1 General

Telescopic stands may be described as a series of platform assemblies or tiers, supported on main vertical columns that wheel or interface with the main floor surface in such a way as to allow the system to be opened and closed in a front to back direction.

Each row or tier interlocks with the previous one so that when opened and ready for use, the structure acts like a single truss running from a low level at the front to the highest tier at the rear (see Figure 3).



Key

1 Closed depth (C/D)

2 Row depth (R/D)

3 Row rise (R/R)

Figure 3 — Example of telescopic stand

Telescopic stands are usually fixed to the structure of the building but can extend and retract within the room or location. In the case of moveable units, careful consideration must be given to operator/operational safety when moving the system.

Telescopic stands are predominantly sited indoors and require a stable, level and firm floor surface to operate upon. Stands range from small installations with bench seats (often in schools and small sports halls), to very large arena installations with, for example, 10,000 fully upholstered, individual seats on 20 rows of tiered platforms. These larger projects require considerable specialised engineering design input from the manufacturer.

A seating place is required to provide a minimum viewing standard together with a sufficient level of safety for the spectator body. Viewing standards refer to the ability of a seated spectator to see a predetermined focal point in the activity area. This viewing standard is often referred to as a sight line.

The layout of the seating deck and the geometry of the deck are required to provide for the safe access and egress of spectators.

Protective barriers on the perimeter of the seating deck and within the seating layout provide protection against falling.

The supporting structure is required to safely resist the static and dynamic forces created by the spectator body and in the case of telescopic stands, particular attention should be made to the horizontal and vertical locking systems that prevent each row or platform from disengaging with the adjacent row or platform.

The material loads and loads of the spectators of telescopic stands shall not exceed the point loads of the bearing capacity of the floor. It has to be considered that resilient sports floors have limited bearing capacities for static and dynamic loads.

Criteria concerning sightline, layout and protection from falling are similar to permanent and telescopic seating decks. However, the nature of vertical support of permanent and telescopic seating decks is significantly different as is the ratio of live load to dead load.

5.2 Telescopic Stand Design

1) Arrangements should be made to ensure, by automatic locking devices or other suitable means, that each stepped platform or row in a telescopic unit is locked when open and in the fully extended position and cannot retract or close accidentally.- (see Figure 3).

2) Arrangements should be made to ensure that by interlocking the structure at the top of the main column positions or front beam position, that when open and ready for use, one row of platform cannot disengage from the row below (see Figure 3).

3) Each stepped tier or platform should contact the floor with a sufficient number of wheels (if wheels are used) such that the resultant loading arising from spectator occupancy is compatible with the floor type the stand is placed upon. The recommended minimum diameter of each wheel is 100mm with a minimum width of 40mm.

4) To ensure stability, when stands are not attached to a building, the **height** to **closed depth** ratio of mobile (moveable) telescopic units when the units are closed and ready to be moved should not exceed **3,5:1.** If this ratio is exceeded, documentary proof and a recorded risk analysis are to be in place (see Figure 3).

5) All removeable guard rails and all loose ancillary items should be locked securely in place.

6) All fastening devices shall be designed in a manner so that unauthorised opening is impossible.

7) Where electric gangway/aisle lighting and/or power operation is specified, it should comply with the relevant National Electrical Standards and specifications of the country where the product is to be installed.

8) A clearly visible label should be applied to each seating unit or block stating the name and logo of the manufacturer, the reference model, the design capacity (number of spectators), the year of manufacture and the reference number of this European standard.

9) Telescopic stands shall be used in accordance with the manufacturer's instructions and deployed in accordance with layouts approved by the relevant Licensing Authority. An operating manual is to be provided for each installation referenced to the actual installation providing the contractors logo and contact number, reference of the model, a parts list including part numbers, layout drawings, full operational detail (including how to open, close and move the stand) and maintenance information with maintenance instructions and frequency.

10) The design and suitability for use of telescopic stands should be checked by an independent authority

5.3 Sightlines

Requirements and recommendations pertaining to sightlines are given in EN 13200–1.

5.4 Basic specification

5.4.1 General

Telescopic stands shall fulfil the national regulations for fire regulations, escape rules and emergency exit rules.

Seats are to be a constant depth throughout the length of a row. Where seats tip-up automatically the width of the seat-way (clear-way) should be measured between the back of one seat unit and the maximum projection of the seat unit behind when the seat is in the upright position.

With respect to relative lateral positioning, seat centres should be a minimum of 450 mm apart for seats without arms and a minimum of 500 mm for seats with arms.

In tiered seating blocks the **maximum** Row Rise should not exceed:

1) 200mm (190mm) – where **no** half step is provided;

2) 400mm (380mm) – where **one** half step is provided;

3) 600mm (570mm) – where **two** half steps are provided.

In tiered seating blocks the **minimum** riser height or step height is 100 mm. The dismount area adjacent to a stair shall provide a uniform riser height for the lowermost step.

In certain situations parabolic riser configurations can be specified. This is where a small increase in height from one riser to the next increases the riser height steadily towards the rear of the stand. Where this does not meet the standard, it should be dealt with by a risk assessment.

5.4.2 Row depth

Requirements and recommendations are given in EN 13200-1.

5.4.3 Passageways (aisles)

Passageway (aisles) widths to be: 1 100 mm minimum and 1 200 mm recommended.

All vertical gaps in aisles, steps, guard rails, risers and decks shall be constructed in such a way that a sphere with a diameter of 100 mm (recommended) and a maximum diameter of 120 mm cannot pass through any part of the structure. National codes or legislation, where applicable, should be considered and applied.

All horizontal gaps in floors and decks should not permit the passage of a sphere exceeding 30mm in diameter. This gap shall not occur in any aisle space.

5.5 Loading

5.5.1 Self Weight

Self weight is calculated from the unit weights given in EN 1991-1-1 or from the actual known weights of the material used.

5.5.2 Imposed Vertical Loads

The following loading ranges are given in EN 1991-1-1. The recommended values are given in bold numbers.

Category C concerns **areas where people may congregate**.

In particular:

Category C2 concerns areas with fixed seats and the imposed loading is as follows:

Uniformly Distributed Load (UDL) 3,0 to **4,0** kN/m^2.

Category C5 concerns areas susceptible to overcrowding and includes grandstands.

Uniformly Distributed Load (UDL) **5,0** to 7,5 kN/m^2.

All floors should be designed to carry a uniformly distributed load derived using appropriate load factors.

Imposed loads shall be taken into account as quasi-static actions (see EN1990). The load models may include dynamic effects if there is no risk of resonance or other significant dynamic response of the structure (see

Eurocodes standards). If resonance effects from the expected synchronised rhythmical movement of people dancing or jumping, the load model should be determined for special dynamic analysis.

Overcrowding is considered to be greater spectator occupancy of a space than would arise during expected use.

Concentrated loading can arise from spectators jumping from a standing position on seats and may need to be considered as a design requirement. EN 1991-1-1 gives concentrated loads and their manner of application for categories C2 and C5. It is considered that in many cases the concentrated loads given in EN 1991-1-1 will not necessarily apply to telescopic stands. The appropriate concentrated loads for telescopic stands should derive from considering the intended use, a recorded risk analysis and national requirement.

5.5.3 Isolated Loads

The floor or bench components of a telescopic stand shall be capable of withstanding isolated loads of 1 kN spaced accordingly on an 0,50 m orthogonal grid. For purposes of design, the area of application of an isolated load shall be 0,20 m x 0,20 m.

5.5.4 Horizontal Loads

Telescopic stands are subjected to horizontal loads induced by spectator actions.

A notional horizontal load of **6%** of the vertical imposed load shall be applied for the design of all categories of use. Normal deflection criteria in terms of span and overhang shall apply. The ratio of deflection to appropriate span/overhang should not be more than **1:200**.

NOTE 1 Partial factors for dead and imposed loads for use in the limit state design of stands should correspond to the structural code of practice relevant to the material. For notional horizontal loads, the partial factor should be 1,5 for the load combination case with factored values of vertical dead and imposed loads.

NOTE 2 The notional horizontal load should be combined with the operational wind load (exterior use only) for designing the structural elements of a stand.

The stated loads should be considered the minimum values to be adopted.

For the design of structural elements the previously stated loading values should be used in accordance with the relevant standards.

NOTE 3 The uniformly distributed loads provide for the effects of normal use. Telescopic stands are frequently occupied by energetic audiences who subject the structure to dynamic excitation. Telescopic stands are relatively flexible structures which will respond dynamically to spectator movements. The manner in which the designer/manufacturer of any structure likely to be subject to dynamic excitation has considered this matter should be apparent in the design documentation. The possibility of resonant excitation should be considered and where appropriate specialist advice should be sought.

In this context the effect of seismic loads and excitation, if relevant to the country of installation, should also be considered.

5.6 Wind loading

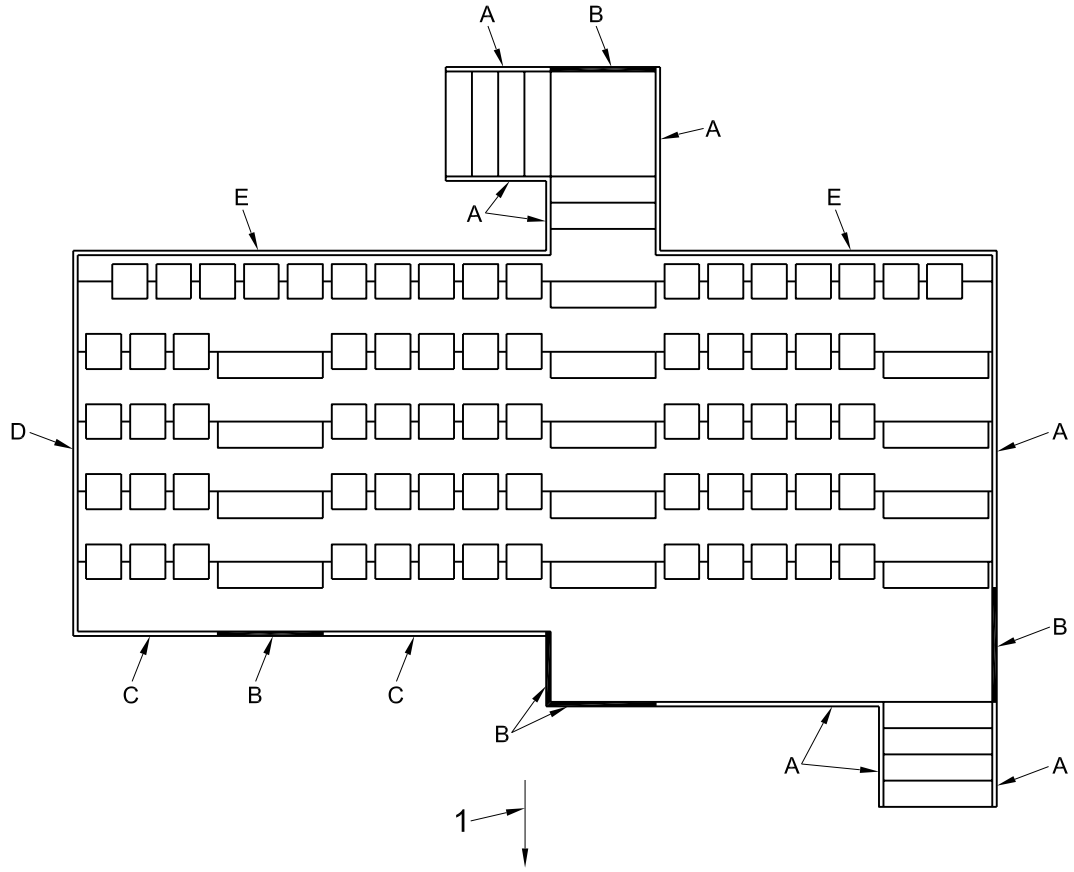
If telescopic stands are to be used outdoors, wind loading calculation shall apply.

5.7 Provisions for people with disabilities

Requirements and recommendations are given in EN 13200-1.

NOTE National building regulations or Disability regulations require provisions to be made for all people, including those with disabilities, at spectator events. It is necessary that these requirements be given due recognition in the provision of telescopic accommodation in all types of facilities.

5.8 Protection from falling



Key

A Barrier Type A

B Barrier Type B

C Barrier Type C

D Barrier Type D

E Barrier Type E

1 Direction of view

Figure 4 — Small elevated seating structure

Figure 4 is a plan view of a small elevated seating structure. The seating deck requires a perimeter guardrail, the elements of which serve various purposes. The characteristics of different types of barriers are given in Table 1.

Table 1 — Types of barriers

Barrier type reference	Barrier type description	Value or recommended range of values of imposed loads (KN/m length)
Type A	provides for the safety of individuals moving along a gangway or using a stairway in a direction parallel to the guardrail	2,0 to 1,5
Type B	provides for safety of individuals subjected to forces arising from spectators moving in a direction perpendicular to the guardrail direction. Individuals in a gangway or on a stair can create considerable horizontal forces on this guardrail through pushing or as a consequence of a domino collapse down the gangway or stairway	3,0 to 2,0
Type C	provides for the safety of individuals entering and exiting seats in the front row	1,5
Type D	provides for the safety of an individual occupying a seat adjacent to the guardrail	1
Type E	provides for the safety of individuals at the rear of the stand	1

The minimum height of a guard rail is 1m and the recommended height is 1,1 m.

Guardrails that interfere with sightlines can be reduced to a height of 800 mm other than where they protect spectators in an passageway or lateral gangway. If a guardrail height less than 900 mm is used, a risk assessment is mandatory.

For rear guardrails, the height of the guardrail is 1,1 m as measured from the seat level.

5.9 Seats

The layout, the number of seats permitted in a row and type of seats are specified in EN 13200-1 and prEN 13200-4.

Where the seat manufacturer makes significant use of materials other than plastic to provide the seating element, due consideration shall be given to the characteristics of the seat including strength and stability. The strength, stability and test methods of seats can be found in EN 12727.

NOTE For guidance on the fire retardancy of seats and structures, National codes apply.

Annex A
(informative)

Process of procurement, installation and use

A.1 General

Spectator accommodation, both indoors and outdoors, provided by telescopic stands, is required to provide levels of safety equal to permanent spectator accommodation.

The design of telescopic stands should be the responsibility of a competent person and the design should be independently checked by a chartered engineer of appropriate skill and experience.

Telescopic stands are generally constructed from steel, aluminium, plywood, timber and plastic, by factory manufactured sub-assemblies. This specialised product should always be installed by a competent person(s) who has been formally trained and authorised by the manufacturer to do so.

A.2 Principal responsibilities

The procurement of telescopic stands and their use should be an integral part of the planning, management and supervision of the facility for which it is required. It is the client's responsibility to provide telescopic stands that are fit for their purpose.

A risk assessment, including a fire risk assessment of the proposed use of the telescopic stands should be made. The contractor should undertake a risk assessment for all aspects of the provision of the structure.

Once the structure has been commissioned and handed over, responsibility for managing all aspects of the structure pass to the client.

The principal responsibilities of the client are to:

— Ensure that competent persons are employed to design, install and commission the telescopic stands.

— During the design stage, agree on the expected spectator activity.

— Provide the contractor with necessary information.

— Recognise the necessary regulatory requirements.

— Appoint a competent technical adviser.

A.3 Specification of requirements

The client should provide the contractor with a written technical specification of requirements, namely:

— Site location and position of the telescopic stands within the facility.

— Type of events to be held in the facility.

— Timetable for supply of the telescopic stands.

— Seat type and number of spectators required on the structure.

— Site access.

— Associated risks.

The division of responsibility should be clearly understood by all parties involved in the design, installation and management of a telescopic stand.

The responsibility for design and installation should rest with the manufacturer.

Design calculations and drawings together with the independent design check should be made available to the client.

After the telescopic stand has been commissioned and installed it shall be properly maintained so that it is fit for use at all appropriate times. The client should arrange for the recommended periodic inspections and where necessary, inform the manufacturer as to any necessary repairs or remedial measures.

The client is responsible for satisfying any regulatory conditions relating to the use of the telescopic stands.

Ready availability of documentation can assist all parties and Table A.1 provides a document checklist.

A.4 Use of Telescopic Stands

Spectators should not be admitted to the telescopic stands for its first use until the client or the client's agent, who should be a competent person, is satisfied that the structure has been properly installed and complies with the design criteria.

Spectators should not be admitted to the telescopic stands for subsequent events until the client is satisfied that the structure has been opened and set in accordance with the manufacturers instructions.

The numbers and distribution of spectators for which a grandstand has been designed should not be exceeded and consideration should be given to the access and egress arrangements. During all events a sufficient number of stewards should be present in order to safeguard spectators.

Table A.1 — Document checklist

Document checklist		
	Document	Prepared by
CLIENT'S REQUIREMENTS		
	Requirements for spectator accommodation	Client
	Regulatory requirements	Client
	Technical requirements (including loading)	Client
SITE and LOCATION		
	Indoor use, allowable floor loading	Client
	Required superimposed loading on stand	Client
DESIGN		
	Evidence of competence	Manufacturer
	Detailed design drawings, calculations and structural limitations	Manufacturer
	Relevant information pertaining to standards, codes and software.	Manufacturer
	Design risk assessment	Manufacturer
	Confirmation of independent design check	Manufacturer
INSTALLATION & COMMISSIONING		
	Evidence of competence	Manufacturer
	Manufacture records of structural components	Manufacturer
	Installation method statements	Manufacturer
	Risk assessment for installation.	Manufacturer
	Confirmation of independent installation check	Client
USE		
	Completion certificate	Manufacturer
	User/Operational Manual	Manufacturer

Bibliography

[1] EN 1990, *Eurocode: Basis of structural design*

[2] CEN/TR 13200-2, *Spectator facilities – Layout criteria of service area – Part 2: Characteristics and national situations*

[3] EN 13200-3, *Spectator facilities – Part 3: Separating elements – Requirements*

[4] EN 13200-6, *Spectator facilities – Part 6: Demountable (temporary) stands*

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