

Temporary works equipment —

Part 1: Scaffolds — Performance requirements and general design

The European Standard EN 12811-1:2003 has the status of a
British Standard

ICS 91.220

National foreword

This British Standard is the official English language version of EN 12811-1:2003. It supersedes BS 5973:1993 which is withdrawn.

The UK participation in its preparation was entrusted by Technical Committee B/514, Access and support equipment, to Subcommittee B/514/21, Access and working scaffolds, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this subcommittee can be obtained on request to its secretary.

It is anticipated that CEN will issue a corrigendum to correct the following items:

- a) in the key of Figure 5, line 3, “see Table 4” will read as “see Table 3”;
- b) in Equation 10 the value “ $2,4M_{B,d}$ ” will read as “ $2,0M_{B,d}$ ”;
- c) in Table C.1 the bending moment $M_{B,k}$ in kN·m for class B, the value “2,4” will read as “1,4”;
- d) in the title of Figure C.2, “and C” will be deleted.

EN 12811-1:2003 is published with three national annexes. National annex NA gives general guidance on the use of this standard. National annex NB gives detailed information on the differences between this standard and BS 5973 (withdrawn). National annex NC discusses the aspects of structural design by limit state covered by this standard, but not considered in BS 5973 (withdrawn).

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled “International Standards Correspondence Index”, or by using the “Search” facility of the *BSI Electronic Catalogue* or of British Standards Online.

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 does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 56, an inside back cover and a back cover.

The BSI copyright notice displayed in this document indicates when the document was last issued.

Amendments issued since publication

Amd. No.	Date	Comments

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 16 June 2004

© BSI 16 June 2004

ISBN 0 580 43279 3

English version

Temporary works equipment - Part 1: Scaffolds - Performance requirements and general design

Equipements temporaires de chantiers - Partie 1:
Echafaudages - Exigences de performance et étude, en
général

Temporäre Konstruktionen für Bauwerke - Teil 1:
Arbeitsgerüste - Leistungsanforderungen, Entwurf,
Konstruktion und Bemessung

This European Standard was approved by CEN on 4 September 2003.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	Page
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions.....	6
4 Materials.....	10
5 General requirements.....	11
6 Requirements for structural design	17
7 Product manual	26
8 Instruction manual	26
9 Work on site.....	27
10 Structural design	27
Annex A (informative) Wind loads on clad working scaffolds.....	35
Annex B (normative) Base jacks; data for calculation	37
Annex C (normative) Characteristic values of the resistances for couplers	41
Annex D (Informative) National A-deviations	44
Bibliography	45
National annex NA (informative) Summary of major points.....	46
National annex NB (informative) Requirements unique to this standard or covered in less detail in BS 5973 (withdrawn)	48
National annex NC (informative) Aspects of structural design covered by this standard but not by BS 5973	54
National bibliography.....	56

Foreword

This document (EN 12811-1:2003) has been prepared by Technical Committee CEN/TC 53 “Temporary works equipment”, the secretariat of which is held by DIN.

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 June 2004, and conflicting national standards shall be withdrawn at the latest by June 2004.

This European Standard is one of the package of standards listed below:

- EN 12810-1, Façade scaffolds made of prefabricated components - Part 1: Product specifications
- EN 12810-2, Façade scaffolds made of prefabricated components- Part 2: Particular methods of structural design
- EN 12811-1, Temporary works equipment – Part 1:– Scaffolds – Performance requirements and general design
- prEN 12811-2, Temporary works equipment.– Part 2: Information on materials
- EN 12811-3, Temporary works equipment – Part 3: Load testing

Annexes A and D are informative. Annexes B and C are normative.

This document includes a bibliography.

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

Introduction

The purpose of a working scaffold is to provide a safe place of work with safe access suitable for the work being done. This European Standard sets out performance requirements for working scaffolds. These are substantially independent of the materials of which the scaffold is made. The standard is intended to be used as the basis for enquiry and design.

As a number of options are given to suit different applications, a choice has to be made between the various alternatives within this European Standard. All other requirements could be in an associated job specification.

Based on these requirements, a set of rules can be drawn up for a particular type of equipment. These may be standard for general use, or specially prepared for a particular job.

This European Standard includes rules for structural design, which are of particular relevance to scaffolds made of certain materials.

For materials this standard refers only to valid EN standards. However a large stock of equipment made of materials conforming to standards no longer valid is in use. This standard does not cover the use of this equipment.

Because the dimensions of the working scaffold depend on the type of work and the method of execution, the corresponding national legal rules should be taken into account.

1 Scope

This European Standard specifies performance requirements and methods of structural and general design for access and working scaffolds, referred to from hereon as working scaffolds. Requirements given are for scaffold structures, which rely on the adjacent structures for stability. In general these requirements also apply to other types of working scaffolds. Normal requirements are set down, but there is also provision for special cases.

This European Standard also specifies structural design rules when certain materials are used and general rules for prefabricated equipment.

The standard excludes:

- platforms suspended by ropes, whether fixed or movable;
- horizontally movable platforms including Mobile Access Towers (MAT);
- power-operated platforms;
- scaffolds used as protection for roof work;
- temporary roofs.

NOTE 1 Most working scaffolds are formed from prefabricated components or from tubes and couplers. Some examples of working scaffolds are façade scaffolds, static towers and birdcage scaffolds, but details are not given for all of these.

NOTE 2 Falsework and shoring may be made of the structural components described in this standard, but are not working scaffolds.

NOTE 3 Particular requirements for façade scaffolds made of prefabricated components are specified in EN 12810 -1 and EN 12810-2.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to apply (including amendments).

EN 74: 1988, *Couplers, loose spigots and base-plates for use in working scaffolds and falsework made of steel tubes – Requirements and test procedures.*

prEN 74-1, *Couplers, spigots and baseplates for use in falsework and scaffolds – Part 1: Couplers for tubes – Requirements and test methods.*

EN 338, *Structural timber – Strength classes.*

EN 12810-1:2003, *Façade scaffolds made of prefabricated elements – Part 1: Product specifications.*

EN 12810-2, *Façade scaffolds made of prefabricated elements – Part 2: Methods of particular design and assessment.*

prEN 12811-2: *Temporary works equipment – Part 2: Information on materials.*

EN 12811-3: *Temporary works equipment – Part 3: Load testing.*

prEN 12812:1997, *Falsework - Performance requirements and general design.*

ENV 1990, *Eurocode 1: Basis of structural design.*

ENV 1991-2-4, *Eurocode 1: Basis of design and actions on structures – Part 2-4: Wind actions.*

ENV 1993-1-1:1992, *Eurocode 3: Design of steel structures – Part 1-1: General rules and rules for buildings.*

ENV 1995-1-1, *Eurocode 5: Design of timber structures – Part 1-1: General rules and rules for buildings.*

ENV 1999-1-1:1998, *Eurocode 9: Design of aluminium structures – Part 1-1: Common rules.*

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply (see also Figure 1):

3.1 anchorage

means inserted in, or attached to, the structure for attaching a tie member

NOTE The effect of an anchorage may be achieved by the tie being connected to a part of the structure primarily intended for other purposes, see 3.23.

3.2 base jack

base plate, which has a means of vertical adjustment

3.3 base plate

plate used for spreading the load in a standard over a greater area

3.4 birdcage scaffold

scaffold structure comprising a grid of standards and a decked area usually intended for working or storage

3.5 bracing in horizontal plane

assembly of components which provides shear stiffness in the horizontal planes, e.g. by decking components, frames, framed panels, diagonal braces and rigid connections between transoms and ledgers or other items used for horizontal bracing

3.6 bracing in vertical plane

assembly of components which provides shear stiffness in the vertical planes, e.g. by closed frames with or without corner bracing, open frames, ladder frames with access openings, rigid or semi-rigid connections between horizontals and the vertical components, diagonal bracing, or other items used for vertical bracing

3.7 cladding

material normally intended to provide weather and dust protection, typically sheeting or netting

3.8 coupler

device used to connect two tubes

3.9 design

conception and calculation to produce a scheme for erection

3.10**ledger**

horizontal member normally in the direction of the larger dimension of the working scaffold

3.11**modular system**

system in which transoms and standards are separate components where the standards provide facilities at predetermined (modular) intervals for the connection for other scaffold components

3.12**netting**

pervious cladding material

3.13**node**

theoretical point where two or more members are connected together

3.14**parallel coupler**

coupler used for connecting two parallel tubes

3.15**platform**

one or more platform units in one level within a bay

3.16**platform unit**

unit (prefabricated or otherwise) that supports a load on its own and which forms the platform or part of the platform and may form a structural part of the working scaffold

3.17**right angle coupler**

coupler used for connecting two tubes crossing at a right angle

3.18**sheeting**

impervious cladding material

3.19**side protection**

set of components forming a barrier to protect people from the risk of falling and to retain materials

3.20**sleeve coupler**

coupler used for joining two tubes located co-axially

3.21**standard**

upright member

3.22**swivel coupler**

coupler used for connecting two tubes crossing at any angle

3.23**tie member**

component of the scaffold, which connects it with an anchorage at the structure

3.24

transom

horizontal member normally in the direction of the smaller dimensions of the working scaffold

3.25

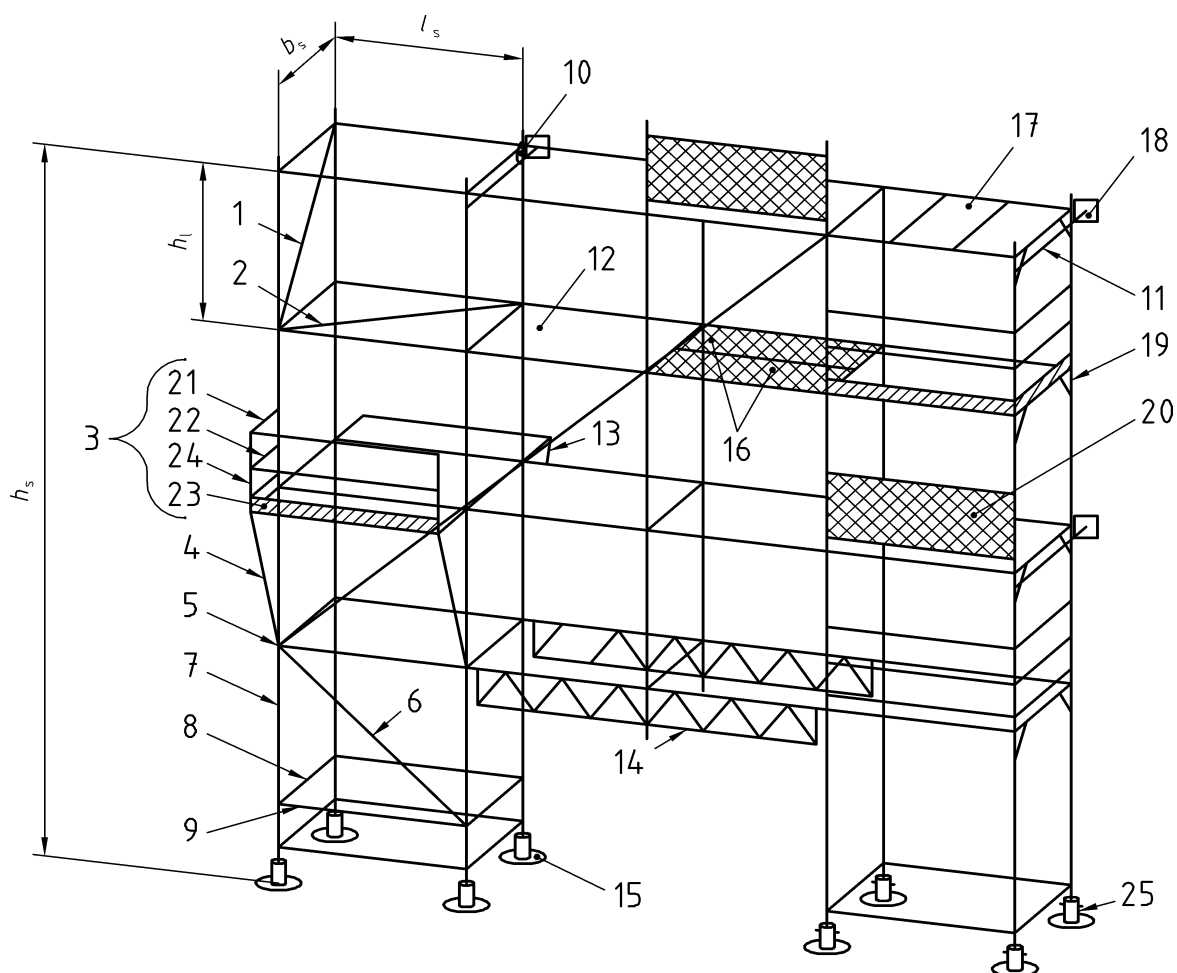
working area

sum of the platforms in one level, to provide an elevated safe place for people to work on and to give access to their work.

3.26

working scaffold

temporary construction, which is required to provide a safe place of work for the erection, maintenance, repair or demolition of buildings and other structures and for the necessary access



Key

h_s	Scaffold height	11	Tie member (3.23)
b_s	Scaffold bay width, centre to centre of standards	12	Platform (3.15)
l_s	Scaffold bay length, centre to centre of standards	13	Bracket (-)
h_l	Scaffold lift height	14	Bridging ledger (-)
1	Bracing in vertical plane ((transverse diagonal) (3.6)	15	Base plate (3.3)
2	Bracing in horizontal plane (3.5)	16	Platform unit (3.16)
3	Side protection (3.19)	17	Horizontal frame (-)
4	Bracket brace (-)	18	Anchorage (3.1)
5	Node (3.13)	19	Vertical frame (-)
6	Bracing in vertical plane (longitudinal diagonal) (3.6)	20	Fencing structure (5.5.5)
7	Standard (3.21)	21	Principal guardrail (5.5.2)
8	Transom (3.24)	22	Intermediate guardrail (5.5.3)
9	Ledger (3.10)	23	Toeboard (5.5.4)
10	Coupler(3.8)	24	Post (-)
		25	Base jack (3.2)

NOTE 1 The Figure is for component identification purposes only and does not show any requirements.

NOTE 2 (-) These terms are not found in the text, but are useful to understand the various components that can be used with a working scaffold.

Figure 1 — Examples of typical components of a façade scaffold system

4 Materials

4.1 General

Materials shall fulfil the requirements given in European Standards, where design data are provided.

Information for the most commonly used materials is given in prEN 12811-2. Material used shall be sufficiently robust and durable to withstand normal working conditions.

Materials shall be free from any impurities and defects, which may affect their satisfactory use.

4.2 Specific material requirements

4.2.1 Steel

4.2.1.1 General

Steels of deoxidation type FU (rimming steels) shall not be used.

4.2.1.2 Loose tubes

Loose tubes to which it is possible to attach couplers complying with prEN 74-1 (i.e. nominal 48,3 mm outside diameter) shall have a minimum nominal yield strength of 235 N/mm² and a minimum nominal wall thickness of 3,2 mm.

NOTE Loose tubes are usually found in tubes and couplers scaffolds but can also be used in façade scaffold made of prefabricated components e.g. to tie a working scaffold to the façade

4.2.1.3 Tubes for prefabricated components for scaffold systems

For tubes incorporated in prefabricated components for scaffold systems according to EN 12810-1 of nominal outside diameter of 48,3 mm the specifications of EN 12810-1 apply.

Tubes shall not be indented beyond the limits in prEN 74-1 when couplers are attached.

Tubes of external nominal diameter different from the range of 48,3 mm, other than side protection, shall have the following nominal characteristics:

- wall thickness $\geq 2,0$ mm
- yield stress, R_{eH} ≥ 235 N/mm²
- elongation, A ≥ 17 %

4.2.1.4 Side protection

Items used exclusively for side protection, other than toe-boards, shall have a minimum nominal wall thickness of 1,5 mm. For toeboards the minimum nominal wall thickness shall be 1,0 mm. A lesser thickness may be used if the serviceability and load bearing capacity is ensured for instance by the use of stiffening sections, bracing or shaping of the cross section.

4.2.1.5 Platform units

Platform units and their immediate supports shall have a minimum nominal thickness of 2,0 mm. A lesser thickness may be used if the serviceability and load bearing capacity is ensured for instance by the use of stiffening sections, bracing or shaping of the cross section.

4.2.1.6 Protective coating for components

Components shall be protected as determined in prEN 12811-2.

4.2.2 Aluminium alloys

4.2.2.1 Loose tubes

Loose tubes, to which it is possible to attach couplers complying with prEN 74-1 (i.e. 48,3 mm nominal outside diameter), shall have a minimum nominal 0,2 % proof stress of 195 N/mm² and a minimum nominal wall thickness of 4,0 mm.

4.2.2.2 Tubes for prefabricated components for scaffold systems

For tubes incorporated in prefabricated components in scaffold systems according to EN 12810-1 of nominal outside diameter of 48,3 mm the requirements of EN 12810-1 apply.

4.2.2.3 Side protection

Items used solely for side protection shall have a minimum nominal wall thickness of 2,0 mm. A lesser thickness may be used if the serviceability and load bearing capacity is ensured for instance by the use of stiffening sections, bracing or shaping of the cross section.

4.2.2.4 Platform units

Platform units and their immediate supports shall have a minimum nominal thickness of 2,5 mm. A lesser thickness may be used if the serviceability and load bearing capacity is ensured for instance by the use of stiffening sections, bracing or shaping of the cross section.

4.2.3 Timber and timber based materials

Timber shall be stress graded in accordance with EN 338.

If a protective coating is used, it shall not prevent the discovery of defects in the material.

Plywood for platform units shall have at least five plies and a minimum thickness of 9 mm.

Plywood platform units assembled ready for use shall be capable of retaining a circular steel bar of 25 mm diameter and 300 mm length falling endwise from a height of 1 m.

Plywood shall have a good durability with regard to climatic conditions.

5 General requirements

5.1 General

Every area for access and working shall be so arranged as to provide a convenient working place, and to:

- protect people from the risk of falling;
- provide safe storage of materials and equipment;
- protect those below from falling objects.

Attention shall be paid to ergonomic considerations.

The area shall be fully decked and shall be provided with appropriate side protection (see 5.5) when ready for use.

Connections between separate parts shall be effective and easy to monitor. They shall be easy to assemble and secure against accidental disconnection.

5.2 Width classes

The width, w , is the full width of the working area including up to 30 mm of the toeboard, see Figure 2. Seven width classes are given in Table 1.

NOTE 1 In some countries minimum widths are laid down for various types of work activity.

The clear distance between standards, c , shall be at least 600 mm; the clear width of stairways shall not be less than 500 mm.

Each working area, including the corners, shall have its specified width along its full length. This requirement does not apply in the immediate vicinity of a pair of standards, where there shall be a completely unimpeded area with a minimum width, b and p in accordance with the dimensions given in Figure 2.

NOTE 2 When equipment or materials are placed on the working area, consideration should be given to maintaining space for work and access.

Table 1 — Width classes for working areas

Width class	W in m
W06	$0,6 \leq w < 0,9$
W09	$0,9 \leq w < 1,2$
W12	$1,2 \leq w < 1,5$
W15	$1,5 \leq w < 1,8$
W18	$1,8 \leq w < 2,1$
W21	$2,1 \leq w < 2,4$
W24	$2,4 \leq w$

5.3 Headroom

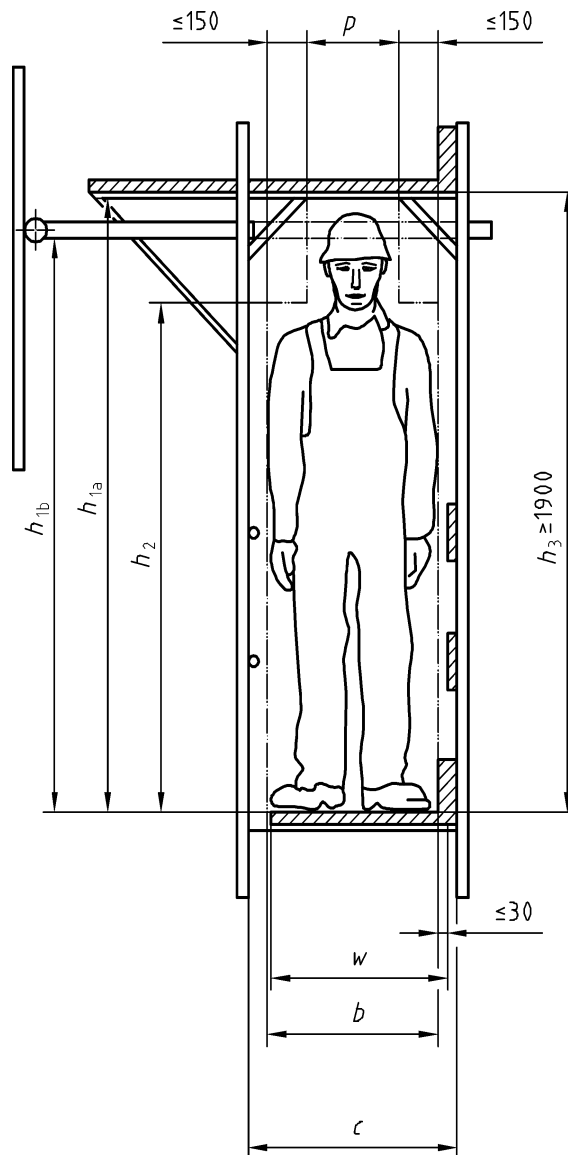
The minimum clear headroom, h_3 , between working areas shall be 1,90 m.

The headroom requirements for the height h_{1a} between working areas and transoms or for the height h_{1b} (see Figure 2) between working areas and tie members are given in Table 2.

Table 2 — Headroom classes

Class	Clear headroom		
	Between working areas h_3	Between working areas and transoms or tie members h_{1a}, h_{1b}	Minimum clear height at shoulder level h_2
H_1	$h_3 \geq 1,90 \text{ m}$	$1,75 \text{ m} \leq h_{1a} < 1,90 \text{ m}$ $1,75 \text{ m} \leq h_{1b} < 1,90 \text{ m}$	$h_2 \geq 1,60 \text{ m}$
H_2	$h_2 \geq 1,90 \text{ m}$	$h_{1a} \geq 1,90 \text{ m}$ $h_{1b} \geq 1,90 \text{ m}$	$h_2 \geq 1,75 \text{ m}$

NOTE For side protection, see 5.5.



Key

- b = free walking space, which shall be at least the greater of 500 mm and $(c - 250)$ mm
 c = clear distance between standards
 h_{1a} , h_{1b} = clear headroom between working areas and transoms or tie members respectively
 h_2 = clear shoulder height
 h_3 = clear headheight between working areas
 p = clear headheight width, which shall be at least the greater of 300 mm and $(c - 450)$ mm
 w = width of the working area in accordance with clause 5.2

Figure 2 — Requirements for headroom and width of working areas

5.4 Working areas

- a) It shall be possible to secure platform units against dangerous displacement e.g. unintended dislodging or uplifting by wind forces.

- b) Platform units should have a slip-resistant surface.

NOTE A timber surface normally meets the requirements for slip-resistance. The risk of tripping from any method used to secure the platform unit or from overlapping should be minimised.

- c) The gaps between platform units shall be as small as possible but not exceeding 25 mm.
- d) Working areas shall be as level as practicable. If the slope exceeds 1 in 5, securely attached full width footholds shall be provided. Except that, where necessary, there may be gaps not exceeding a width of 100 mm in the centre of the footholds to facilitate the use of wheelbarrows.

5.5 Side protection

5.5.1 General

Working and access areas shall be safeguarded by a side protection consisting of at least a principal guardrail, intermediate side protection and a toeboard. See Figure 3. The toeboard may be dispensed with on stairways.

Side protection shall be secured against unintended removal.

For structural design requirements, see clause 6.

NOTE 1 The side protection should not be provided by cladding on its own.

NOTE 2 For special cases e.g. use of working scaffolds in vertical formwork there may be a need of inclined side protection, which is outside the field of application of this standard.

dimensions in millimetres

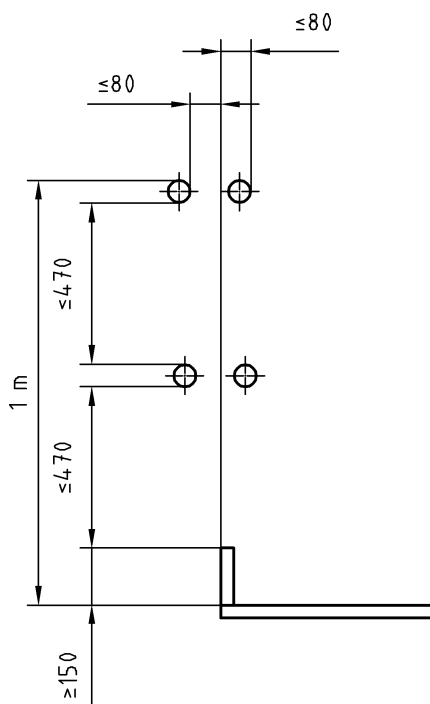


Figure 3 — Dimensions for vertical side protection with one intermediate guardrail

5.5.2 Principal guardrail

The principal guardrail shall be fixed so that its top surface is 1 m or more above the adjacent level of the working area everywhere (absolute minimum height 950 mm).

5.5.3 Intermediate side protection

Intermediate side protection shall be fixed between the principal guardrail and the toeboard. Intermediate side protection may consist of:

- one or more intermediate guardrails, or
- a frame, or
- a frame of which the principal guardrail forms the top edge, or
- a fencing structure

Openings in the side protection shall be so dimensioned that a sphere with a diameter of 470 mm will not pass through them.

5.5.4 Toeboard

A toeboard shall be fixed so that its top edge is at least 150 mm above the adjacent level of the working area. Holes and slots in a toeboard shall, except for handling holes be no larger than 25 mm in one direction.

5.5.5 Fencing structures

The area of each hole or slot in fencing structures shall not exceed 100 cm². In addition, the horizontal dimension of each hole or horizontal slot shall not exceed 50 mm.

5.5.6 Location of the components of the side protection

The horizontal distance between the outer face of the toeboard and the inner face of the guardrail and all the components of the intermediate side protection shall not exceed 80 mm.

5.6 Cladding

Where cladding of the working scaffold is required, this standard assumes that the scaffold will be clad with either netting or sheeting.

5.7 Base plates and base jacks

5.7.1 General

The strength and rigidity of the base plates and base jacks shall be sufficient to ensure that it can transmit the maximum design load from the working scaffold to the foundations. The area of the end plate shall be a minimum of 150 cm². The minimum width shall be 120 mm.

5.7.2 Base plates

Base plates made of steel shall conform to EN 74.

5.7.3 Base jacks

Base jacks shall be provided with a centrally positioned adjusting spindle of such dimensions that, in the unloaded condition, the greatest inclination of the axis of the shaft from the axis of the standard does not exceed 2,5 %. The minimum overlap length at any position of adjustment shall be 25 % of the total length of the shaft, or 150 mm whichever is greater. The thickness of the endplate shall be at least 6 mm. Shaped endplates shall have at least the same rigidity.

5.7.4 Joints between standards with hollow sections

The overlap length in joints between standards shall be at least 150 mm. It may be reduced to a minimum of 100 mm if a locking device is provided.

5.8 Access between levels

5.8.1 General

Safe and ergonomic means of access shall be provided.

The scaffold system shall include provision for access between the different levels. This shall be by inclined ladders or stairs. It shall be within the platform, within a widening of the working scaffold at one bay or in a tower immediately adjacent.

Ladders in accordance with EN 131-1 and EN 131-2 may be assumed to satisfy the requirements for access in this standard.

The stairways and ladders shall be secured against unintentional loosening and shall have a slip resistant surface.

NOTE 1 When extensive work is carried out, stairways should be provided for access.

NOTE 2 For taller scaffolds consideration should be given to the use of a passenger hoist.

5.8.2 Stairways

To cater for different requirements for stairways this European Standard specifies two classes of stairway dimensions. The dimensions of stair flights shall be in accordance with Figure 4 and the following:

The combination of values for the rise, u , and the going, g , shall be in accordance with expression (1):

$$540 \leq 2u + g \leq 660 \text{ in mm} \quad (1)$$