SLOVENSKI STANDARD
SIST HD 1000:2000

01-maj-2000

Delovni odri iz predizdelanih tipskih elementov (sistemski odri) - Materiali, mere, obtežbe in varnostne zahteve

Service and working scaffolds made of prefabricated elements - Materials, dimensions, design loads and safety requirements

Arbeitsgerüste aus vorgefertigten Bauteilen (Systemgerüste) - Werkstoffe, Gerüstbauteile, Abmessungen, Lastannahmen und sicherheitstechnische Anforderungen

Echafaudages de service en éléments préfabriqués - Matériaux, dimensions, charges de calcul et exigences de sécurité

Ta slovenski standard je istoveten z: **HD 1000:1988**

ICS:

91.220	Gradbena oprema	Construction equipment

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English version

Service and working scaffolds
made of prefabricated elements
Materials, dimensions, design loads and safety requirements

Echafaudages de service en éléments préfabriqués; Matériaux, dimensions, charges de calcul et exigences de sécurité

Arbeitsgerüste aus vorgefertigten Bauteilen (Systemgerüste); Werkstoffe, Gerüstbauteile, Abmessungen, Lastannahmen und sicherheitstechnische Anforderungen

This Harmonization Document was accepted by CEN on 1988-02-09. CEN members are bound to comply with the requirements of the CEN/CENELEC Rules which stipulate the conditions for giving this Harmonization Document the status of a national document without any alteration.

Up-to-date lists and bibliographical references concerning such national Harmonization Documents may be obtained on application to the CEN Central Secretariat or to any CEN member.

This Harmonization Document exists in the 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 CEN Central Secretariat has the same status as the official versions.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat : Rue Bréderode 2, B-1000 Brussels

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Brief history

At the request of Denmark CEN/TC 53 began work in 1974 on the standardization of the item "Service and Working Scaffolds made of Prefabricated Elements - Materials, Dimensions, Design Loads and Safety Requirements". Since then twelve draft proposals have been studied. At its 19th plenary meeting in March 1984 CEN/TC 53 decided to publish a revised draft proposal as a European Harmonization Document. After discussion of technical changes proposed on the occasion of the preliminary vote CEN/TC 53 decided in November 1986 to propose a revised Harmonization Document and sent it to the Central Secratariat for final vote. As soon as International Reference Standards for materials and factors of safety are available this Harmonization Document can be considered for adoption as an EN.

During discussion of the draft it was noted that the average height of people is increasing and that consideration will have to be given in later editions to altering vertical dimensions.

Work is proceeding in CEN/TC 53 on the preparation of European Standards for:

- Methods of test for elements and assembled scaffolds and
- methods of assessment and calculation.

According to the Common CEN/CENELEC rules, the following countries are bound to implement this Harmonization Document:

Finland, France, Germany, Greece, Ireland, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

Contents

1 Object and field of application

This Harmonization Document applies to unsheeted anchored prefabricated service and working scaffolds for facades. The requirements described are intended to ensure that scaffolds complying with this Harmonization Document are capable of being erected to a height of 30 m (measured from ground level to the highest platform) under specified loading conditions. The Harmonization Document:

- gives guidelines for the choice of the main dimensions of prefabricated scaffolds
- classifies prefabricated scaffolds according to their loading
- specifies properties for materials to be used
- gives safety engineering requirements and dimensions
- specifies a basic version of an assembled structure.

This Harmonization Document does not specify requirements for ladder components or other means of access between platforms or for sheeted scaffolds.

2 References to other standards

Since other European Standards are not at present available, reference should be made to the relevant standards listed in the national annexes of this Harmonization Document.

Note:
From the date of completion of these European Standards the national standards are to be considered as B-deviation. For the sake of simplicity the concerning applications are already now indicated as B-deviations. At that moment a time limit for the application of national standards as B-deviations should be published.

3 Definitions

For the purpose of this Harmonization Document the following definitions apply (see also figure 1):

3.1 Prefabricated scaffold: Scaffold in which some or all the dimensions are predetermined by connections or connecting devices that are permanently fixed to the components.

3.2 Bracing member

3.2.1 Bracing member in the horizontal plane: Frames, framed panels, diagonal braces and rigid connections between transoms and ledgers, etc. used for horizontal bracing.

3.2.2 Bracing member in the vertical plane: Closed frames with or without corner bracing, open frames, ladder frames with access openings, rigid connections of the transoms to the vertical tubes, diagonal bracing, etc. used for vertical bracing.

3.2.3 Tie member: Component connecting the scaffold to the anchorages in the facade of the building.

3.3 Basic version: See clause 11.

3.4 Horizontal frame: Component which provides a continuous horizontal stiff plane (see typical example given in figure 2).

3.5 Vertical frame: Component which provides a continuous vertical stiff plane (see typical example given in figure 3).

3.6 Horizontal/vertical framing system: Systems that are continuously braced in vertical and horizontal planes, thus using both types of units defined in 3.4 and 3.5.

3.7 Modular system: A prefabricated scaffold where the connections to standards are made by prefabricated joints which are at regular (modular) intervals.

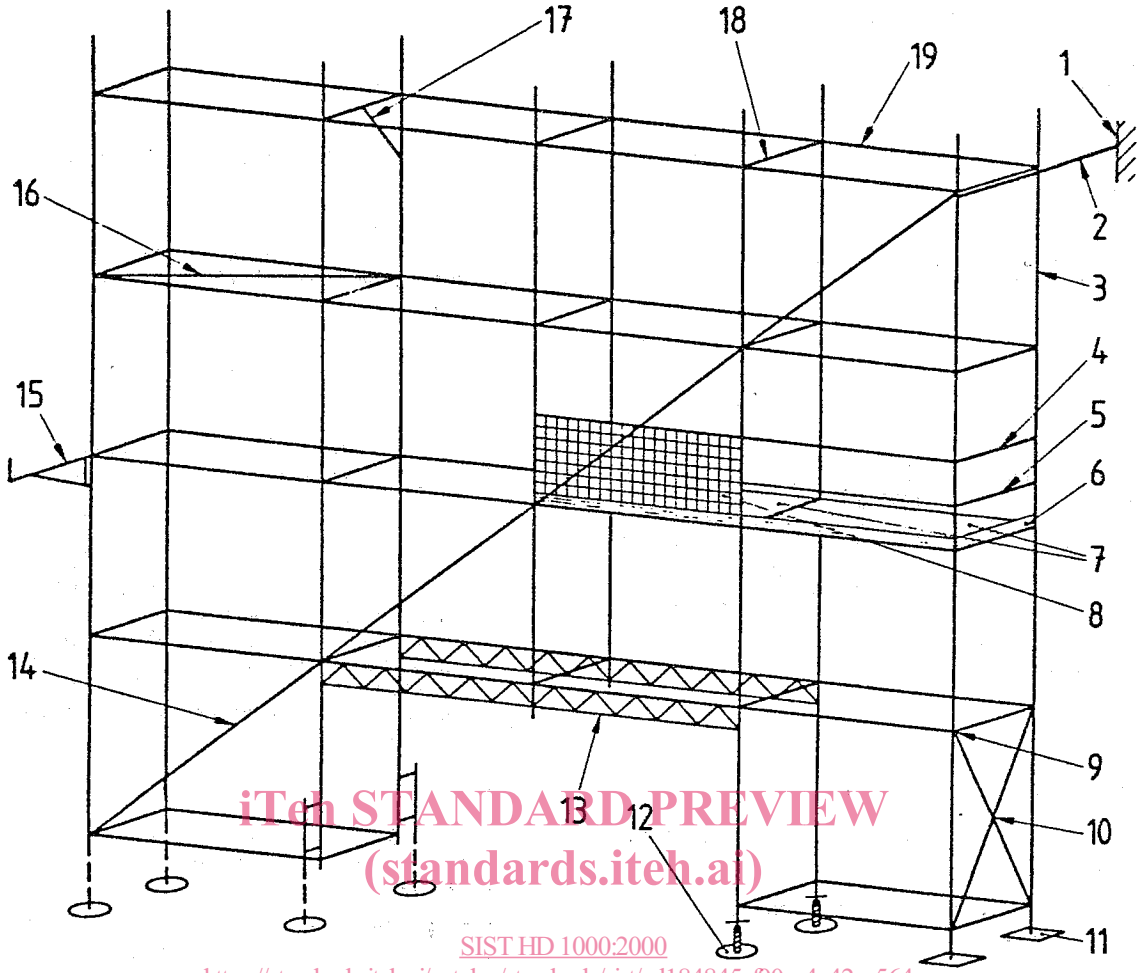
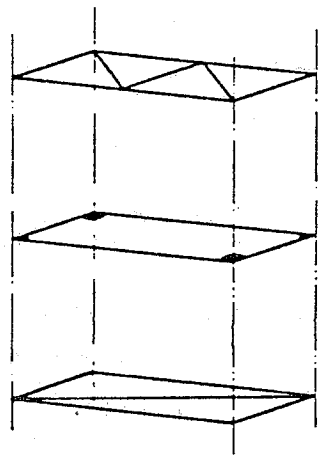
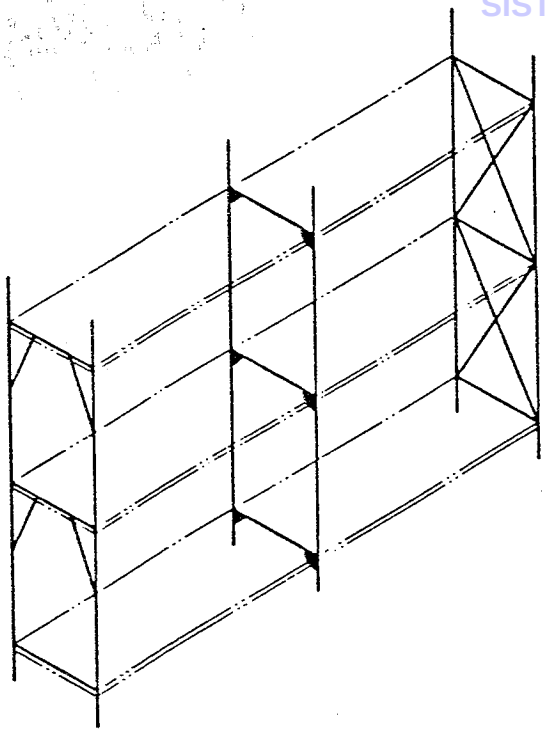


Figure 1. Identification of typical components of a prefabricated scaffold system (The figure 1 is given as an example; examples of stiff planes are given in figures 2 and 3.)

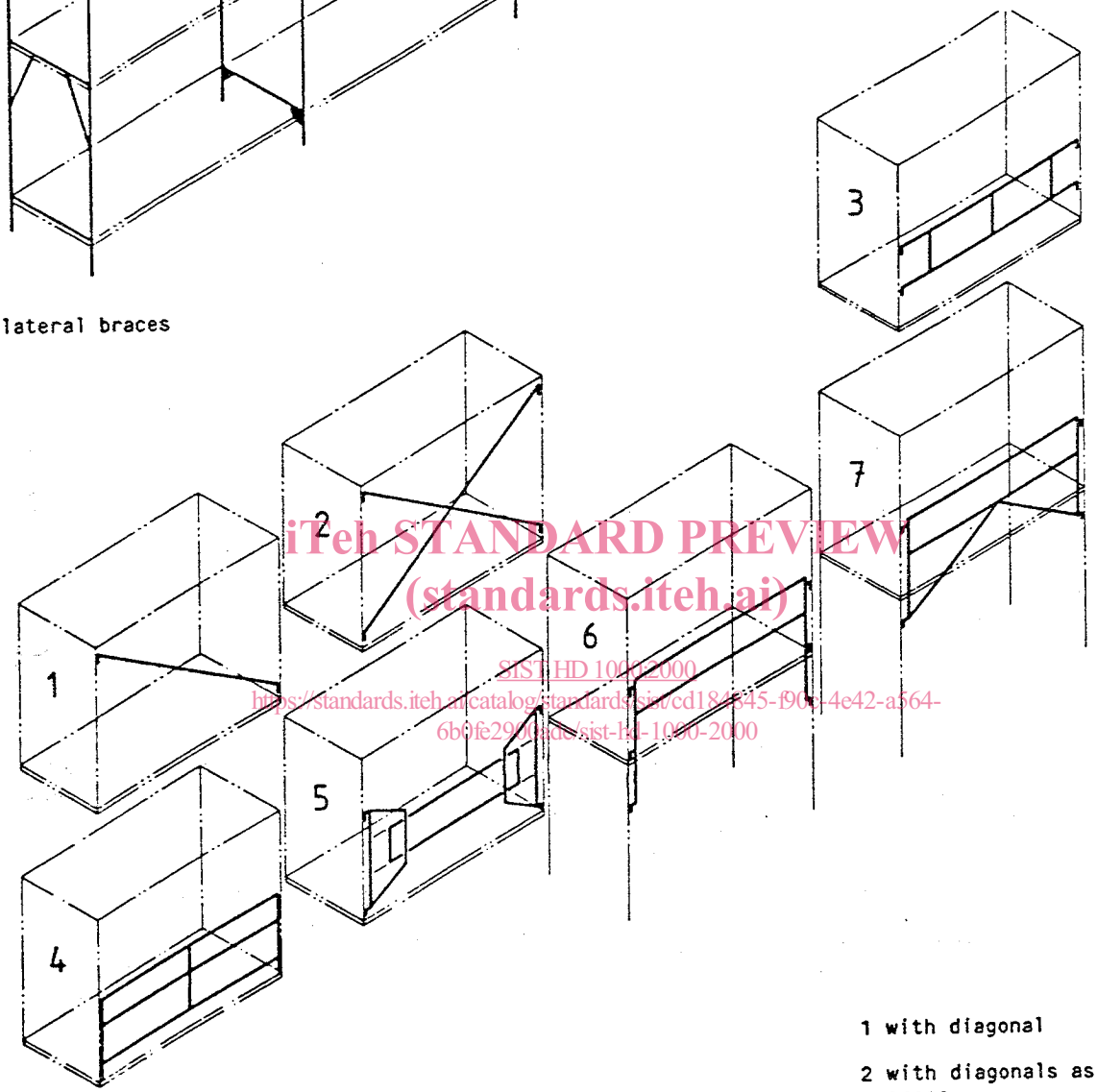


1 Anchorage
2 Tie member
3 Standard
4 Guardrail
5 Intermediate guardrail
6 Toeboard
7 Platform
8 Fencing structure
9 Node
10 Lateral brace (example shown is a cross brace)
11 Non-adjustable base plate
12 Adjustable base plate
13 Bridging ledger
14 Longitudinal brace
15 Hop-up bracket
16 Plan brace
17 Knee brace
18 Transom
19 Ledger

Figure 2. Example of stiff horizontal planes



a) lateral braces



b) longitudinal braces

1 with diagonal

2 with diagonals as St. Andrew's cross

3 with guardrail and intermediate guardrail as ledger

4 frame with guardrail, intermediate guardrail and standard

5 frame consisting of three parts as braces

6 bridging frame as side protection on the construction level

7 bridging frame with braces as side protection on the construction level

Figure 3. Examples of stiff vertical planes

3.8 Decking component: A unit of decking that supports a load on its own.

3.9 Platform: One or more decking components forming a working area.

NOTE:
Prefabricated decking components can form part of the structure of the scaffold. When traditional timber planks are used, they are usually supplied separately.

3.10 Anchorage: The means inserted in, or attached to, the facade of a building for fastening a tie member.

3.11 Ledger: A horizontal member normally parallel to the facade of a building in the direction of the larger dimension of the scaffold.

3.12 Standard: A vertical (or nearly vertical) member.

3.13 Transom: A horizontal member normally fixed at right angles to the face of the building.

4 Materials

Materials shall have a good resistance to, or be protected against, atmospheric corrosion and shall be free of any impurities and defects which might affect their satisfactory use.

Where appropriate, materials shall comply with the national standards which are given in the national annexes.

Welded components shall be made of materials other than rimming steel.

5 Design loads

5.1 General

The design loads specify the strength requirements for platforms and for the scaffold structure according to the classification of the scaffold (see table 1). The factor of safety given in 5.5 shall be applied when using the loads specified in table 1.

NOTE:
All loads are taken to be static loads. For normal use no impact factors need be added. Additional information for typical uses of classes is given in annex A.

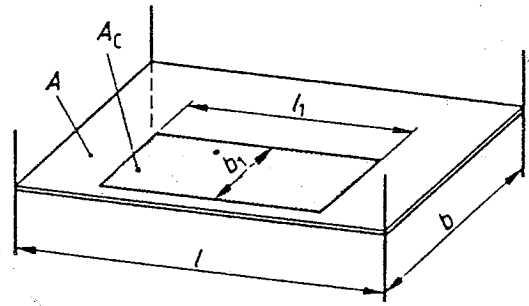


Figure 4. Measurement of total and partial platform areas.

Table 1. Service loads for working platforms[1])

1	2	3	4	5	6
Class	Uniformly distributed load	Concentrated load on area[2]) 500 mm x 500 mm	Concentrated load on area[3]) 200 mm x 200 mm	Partial area load	
					Partial area[4]) A_C
	kN/m²	kN	kN	kN/m²	m²
1[5])	0,75	1,50	1,00	Not applicable	
2	1,50	1,50	1,00	Not applicable	
3	2,00	1,50	1,00	Not applicable	
4	3,00	3,00	1,00	5,00	0,4 · A
5	4,50	3,00	1,00	7,50	0,4 · A
6	6,00	3,00	1,00	10,00	0,5 · A

[1]) See figure 4

[2]) See 5.2.3

[3]) See 5.2.4

[4]) A is the platform area

[5]) See 5.2.1

5.2 Platform

5.2.1 General

For the purpose of design, the platform area (other than cantilevered platforms see 5.2.6) to be considered is that bounded by the actual width of the platform measured perpendicular to the facade and by the centre lines of the pairs of standards. The platform shall satisfy the three or four, as appropriate, loading requirements separately.

The platform and its immediate supports shall be capable of supporting the service loads specified in table 1, except that no platform shall have a load bearing capacity lower than that specified for a class 2 scaffold.

5.2.2 Uniformly distributed load

Each platform shall support a load uniformly distributed over the whole area of the platform as specified in table 1 column 2.

5.2.3 Concentrated load on an area of 500 mm x 500 mm

Each platform shall support the load given in table 1, column 3, uniformly distributed over an area of 500 mm x 500 mm. The position of this load shall be chosen to give the most unfavourable conditions. When the platform contains any independent decking component less than 500 mm wide, the concentrated load shall be reduced for this component in proportion to the width, except that in no case the loading shall be reduced to less than 1,5 kN.

5.2.4 Concentrated load on an area of 200 mm x 200 mm

Each platform shall support a load of 1,0 kN uniformly distributed over an area of 200 mm x 200 mm. The position of this load shall be chosen to give the most unfavorable loading of the platform.

5.2.5 Partial area load

In addition to the requirements of 5.2.2 and 5.2.3, each platform in classes 4, 5 and 6 shall support the load specified in table 1, column 4, uniformly distributed over a single rectangular portion (partial area) of the platform having an area equal to the proportion of the total platform area specified in table 1, column 5 (see figure 4). The dimensions and position of this partial area shall be chosen to give the most unfavourable loading of the platform.

5.2.6 Cantilevered platforms

All cantilevered portions of a platform shall be able to support the same service loads as specified for the main platform (see 5.2.2, 5.2.3 and 5.2.4).

For platforms in classes 4, 5 and 6 incorporating cantilevered areas, where the cantilevered areas do not exceed the width of the adjacent main platform they shall be designed for the same partial area load as that derived for the main platform in the most unfavourable position. Where the width of the cantilevered platform exceeds that of the main platform it shall be designed for a partial area load derived from its own boundary dimensions. A cantilevered platform may have a lower class loading than the adjacent main platform provided that they are at different levels, at least 250 mm apart.

5.2.7 Deflection of decking

When subjected to the concentrated load specified in 5.2.3 the maximum deflection of any decking component shall not exceed 1/100 of the span of that decking component.

In addition, in the case of decking components with spans of 2 m or greater, when the appropriate concentrated load is applied the maximum difference in levels between adjacent loaded and unloaded decking components shall not exceed 20 mm.

5.3 Scaffold structure

5.3.1 General

The scaffold structure when erected to a height of 30 m shall be capable of supporting the worse of the two following conditions:

a) Maximum wind conditions:

- i) Uniformly distributed load appropriate to the class of the scaffold on the platform at the most unfavourable level (see 5.2 and table 1), plus
- ii) self weight of the scaffold, including the mass of 5 platforms, plus
- iii) appropriate maximum wind load (see 5.3.2.1 a)), plus
- iv) load due to inaccuracies in construction (see 5.3.4).

b) Working wind conditions:

- i) Uniformly distributed load appropriate to the class of the scaffold on the platform at the most unfavourable level (see 5.2 and table 1), plus
- ii) uniformly distributed load of 50 % of that in i) on the next platform level down the scaffold, plus
- iii) self weight of the scaffold, including the mass of 5 platforms, plus
- iv) working wind load (see 5.3.2.1 b)), plus
- v) load due to inaccuracies in construction (see 5.3.4).

5.3.2 Loads due to wind

5.3.2.1 Wind loads shall be calculated as described in 5.3.2.2 and 5.3.2.3 for winds acting:

- i) parallel to the facade served by the scaffold
- ii) perpendicular to the facade served by the scaffold.

NOTE:
In these calculations the load due to the wind is considered as applying a pressure on the effective area of the scaffold. The effective area is calculated as the projected area in the direction i) or ii), as appropriate, multiplied by an appropriate overall pressure coefficient (see annex B).

The design wind pressure adopted for these calculations shall be as follows:

a) Maximum wind conditions

A design wind pressure of 600 N/m^2 at the base of the scaffold increasing uniformly to 770 N/m^2 at the height of 24 m and then constant at 770 N/m^2 to the height of 30 m (see figure 5) and acting over the projected area of the scaffold.

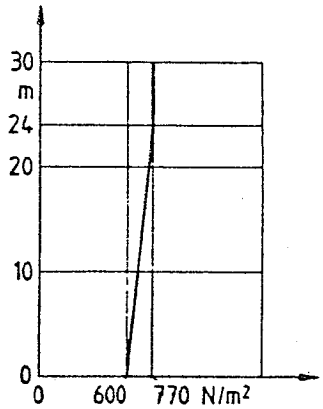


Figure 5. Design wind pressure applying to the height above ground level

NOTE:
Figure 5 represents wind conditions in most parts of Europe. Attention is drawn to the actual wind conditions.

b) Working wind conditions

A design wind pressure of 200 N/m^2 uniformly distributed over the projected area of the scaffold. For the purpose of this calculation only, a nominal area shall be added to the area $A_{\perp r}$ and $A_{\parallel r}$ (see 5.3.2.2 and 5.3.2.3 respectively). This area results from an obstruction to the wind 400 mm high minus height of toeboard. This nominal area is to be considered acting at the surface of the platform.

NOTE:
This nominal area takes into account piles of materials etc.

5.3.2.2 The force parallel to the facade $F_{\parallel}$ in N, shall be calculated from the expression:

$$F_{\parallel} = W \cdot c_{\parallel} \cdot \left[A_{\perp r} + \sum_{1}^{n} \frac{A_{\perp s} \cdot c_f}{1{,}2} \right]$$

where:

W is the appropriate pressure as specified in 5.3.2.1 in N/m^2

$c_{\parallel}$ is the overall pressure coefficient for forces parallel to the supporting structure and has the value 1,1

$A_{\perp r}$ is the total area of all round parts and toeboards projected onto a plane at right angles to the supporting structure in m^2 (see 5.3.2.1 b)

$A_{\perp s}$ is the area of parts of a particular cross section (other than those included in $A_{\perp r}$) projected onto a plane at right angles to the supporting structure in m^2

c_f is the aerodynamic force coefficient appropriate to the cross section of the parts in question, as given in annex B.

5.3.2.3 The force perpendicular to the facade, $F_{\perp}$ in N, shall be calculated from the expression:

$$F_{\perp} = W \cdot c_{\perp} \cdot \left[A_{\parallel r} + \sum_{1}^{n} \frac{A_{\parallel s} \cdot c_f}{1{,}2} \right]$$

where:

W is the appropriate pressure as specified in 5.3.2.1 in N/m^2

$c_{\perp}$ is the overall pressure coefficient for forces perpendicular to the supporting structure and has the value 0,9 (see annex C)

$A_{\parallel r}$ is the total area of all round parts and toeboards projected onto a plane parallel to the supporting structure in m^2 (see 5.3.2.1 b)

$A_{\parallel s}$ is the area of parts of a particular cross section (other than those included in $A_{\parallel r}$) projected onto a plane parallel to the supporting structure in m^2

c_f is the aerodynamic force coefficient appropriate to the cross section of the parts in question, as given in annex B.

5.3.2.4 Where the scaffold crosses in front of large openings in the facade or extends beyond the sides or top, higher forces perpendicular to the facade may occur and the design of the scaffold shall permit these extra loads to be allowed for (see annex C).

NOTE:
In areas with high winds giving pressures exceeding those in 5.3.2 a check should be made by the user to see if there are any limitations on loads applied to scaffolds.

5.3.3 Loads due to snow

No allowance need be made for snow loading.

5.3.4 Loads due to inaccuracies in construction

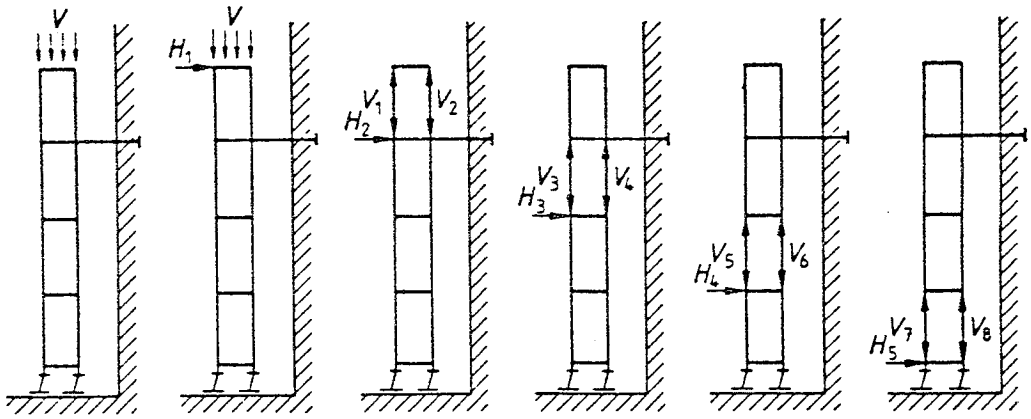
The loads arising in the scaffold as a result of inaccuracies in construction in any one level of the standards linked by transoms, ledgers or horizontal frames shall be considered as using a horizontal load, H, calculated from the expression

$$H = \frac{V_1 + V_2 + V_3 + \ldots + V_n}{100 \sqrt{n}}$$

where V_1 to V_n are the axial loads in each standard

n is the number of linked standards at the level under consideration (see figure 6).

NOTE:
H is a notional load, introduced for design purposes, as a substitute for the effect of the structure being out of plumb. It is not considered as imposing secondary effects due to deflections. It is a function of the total vertical loads applied to vertical members in a linked group of standards and when considering the strength of a scaffold it is calculated and applied separately for each level, i.e. consecutively not concurrently (see figure 6). The load H becomes additional of any other forces generated due to eccentricity of connections or displacements of base plates etc.



1. Load system

Substitute systems:

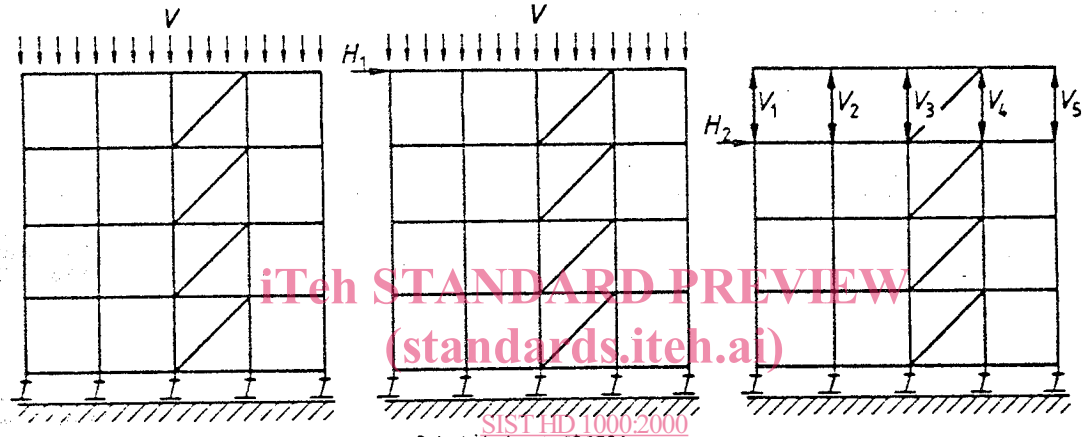
a) $H_1 = \frac{\sum V}{100\sqrt{2}}$

b) $H_2 = \frac{V_1 + V_2}{100\sqrt{2}}$

c) $H_3 = \frac{V_3 + V_4}{100\sqrt{2}}$

d) $H_4 = \frac{V_5 + V_6}{100\sqrt{2}}$

e) $H_5 = \frac{V_7 + V_8}{100\sqrt{2}}$

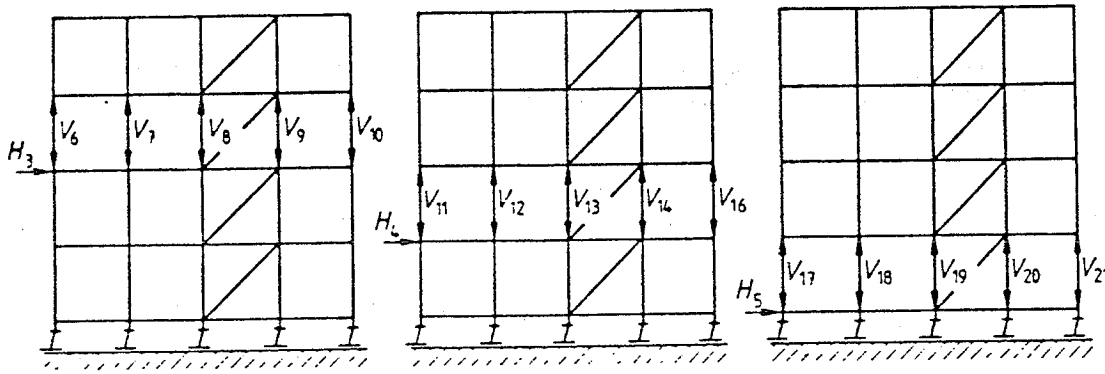


2. Load system

Substitute systems:

a) $H_1 = \frac{\sum V}{100\sqrt{5}}$

b) $H_2 = \frac{V_1 + V_2 + V_3 + V_4 + V_5}{100\sqrt{5}}$



Substitute systems:

c) $H_3 = \frac{V_6 + V_7 + V_8 + V_9 + V_{10}}{100\sqrt{5}}$

d) $H_4 = \frac{V_{11} + V_{12} + V_{13} + V_{14} + V_{16}}{100\sqrt{5}}$

e) $H_5 = \frac{V_{17} + V_{18} + V_{19} + V_{20} + V_{21}}{100\sqrt{5}}$

Figure 6. Examples of checking the effects of inaccuracies in construction

5.3.5 Erection and dismantling loads

The scaffold and all parts of it when being erected or dismantled in accordance with the manufacturer's instructions shall be capable of withstanding all the resultant loads.

5.4 Requirements for guardrails

A guardrail, regardless of its span, shall withstand separately:

a) a point load of 0,3 kN without an elastic deflection of more than 35 mm; and

b) a point load of 1,25 kN without breaking or disconnecting and without being displaced from its original line by more than 200 mm at any point.

Both the above loads shall be applied in the most unfavorable positions and at any horizontal or downward angle. These loads are not additional to those in 5.3.1 or 5.3.2.

5.5 Factors of safety

The various parts of the scaffold shall have a safety factor in accordance with the relevant standards listed in the national annexes.

6 Dimensions

The dimensions of working levels shall comply with the requirements of 10.2.

NOTE 1:
With the exception of working levels this Harmonization Document does not limit the dimensions of prefabricated scaffolds. However, the following dimensions are preferred:

Width[1]) : Classes 1, 2 and 3 scaffolds:
Scaffold width of 0,7 m with minimum platform width of 0,6 m

Classes 4, 5 and 6 scaffolds:
Scaffold width of 1 m with minimum platform width of 0,9 m

Length[1]): Classes 1, 2 and 3 scaffolds:
1,5 m up to 3 m with 0,3 m or 0,5 m steps

Classes 4, 5 and 6 scaffolds:
1,5 m up to 2,5 m and with 0,3 m or 0,5 m steps

Height[2]): minimum 2 m

NOTE 2:
Because the dimensions of the scaffold depend on the type of work and the method of execution the corresponding national rules should be taken into account.

[1]) Measured centre to centre between adjacent standards
[2]) Measured between the upper surfaces of adjacent platforms

7 Tying

7.1 General

The scaffold shall be designed in such a manner that it can be tied to the facade by means of anchorages at suitable points, preferably close to the intersections of vertical members and ledgers. The design of ties shall be suitable for resisting horizontal forces perpendicular to the facade and parallel to the facade.

7.2 Dissipation of horizontal loads

Horizontal loads normal and parallel to the facade are to be allocated to the anchorages if their distribution to the anchorages and over the vertical stiffeners to the bases cannot be made more accurately because of considerations of looseness and rigidity.

NOTE:
At the bottom of the scaffold between the bases and first anchoring level, the horizontal loads may be allocated equally between these anchorages and the bases. Consideration should be paid to the fact that horizontal loads may induce quite high vertical loads in a scaffold.

7.3 Other requirements

The connection to the structure shall provide restraint to inner and outer vertical planes.

Where the tying pattern intended by the design does not include a tie at each pair of standards sufficient strength shall be provided in the horizontal plane to provide restraint from adjacent tied standards.

The scaffold shall have sufficient strength to allow it to be erected with, at any level on the facade, a zone at least 3,8 m high in which there are no ties to the facade.

NOTE 1:
The restraint should preferably be direct to both standards at each tie point, but may be attached to one plane only, provided the resulting force distribution within the scaffold framework is satisfactory.

NOTE 2:
It is preferable for this tie-free zone to be twice the normal clear height between working levels (see 10.2).

NOTE 3:
The requirements for a tie-free zone are to ensure that the scaffold has sufficient strength integral in the design. It is not a limit on the arrangement of ties that may be used in practice.

8 Connections

8.1 General

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

8.2 Vertical spigot and socket connection

When assembled, the horizontal movement (play) between upper and lower components shall not exceed 4 mm.

NOTE 1:
This is the same as a movement away from the centre line of 2 mm.

The maximum angle of play shall not exceed 5 % from the true line. In all cases it shall not be possible to disconnect an upper component laterally until the upper component has been lifted more than 100 mm. If this lateral disconnection can occur before the upper component has been lifted 150 mm, a positive connection shall be provided between upper and lower components. In other cases, where a positive connection is not provided, the spigot and socket arrangement shall be such that the upper unit will return to its correctly assembled position when displaced vertically by 150 mm and then released.

NOTE 2:
A cross pin is an example of such a positive connection.

8.3 Other connections

There shall be equivalent provisions to limit the risk of accidental disconnection.

NOTE:
Other strength requirements of this Harmonization Document may impose further limitations on the arrangement of connections.

9 Base plates

9.1 General

The strength and rigidity of the base plates shall be adequate to effectively transmit the maximum design load from the scaffold to the foundations. The bearing surface of a flat steel base plate shall have a minimum thickness of 5 mm, and the area of contact with the foundation shall have a minimum area of 150 cm^2. The minimum width shall be 120 mm.

9.2 Non-adjustable base plates

Non-adjustable base plates shall be provided with a permanently attached and centrally positioned centering device, having a minimum length of 50 mm. This device shall be so designed that the base plate cannot move laterally by more than 11 mm (see figure 7).

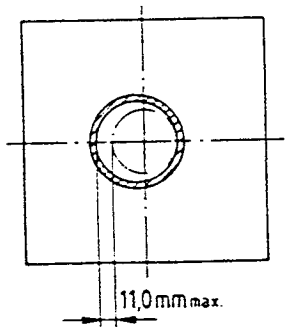


Figure 7. Maximum clearance between centering device and tube in non-adjustable base plate

NOTE:
Base plates complying with EN 74 satisfy the requirements of this Harmonization Document.

9.3 Adjustable base plates

Adjustable base plates shall be provided with a centrally positioned adjusting spindle of such a size that, in the unloaded condition, the greatest inclination of the axis of the spindle from the axis of the standard does not exceed 2,5 %. The minimum length of that part of the spindle remaining in the standard at any position of adjustment shall be 25 % of the total length of the spindle, or 150 mm whichever is the greater.

10 Working levels

10.1 Particular safety requirements

10.1.1 Decking components

Platform decking components shall be durable and shall have a slip-resistant surface. It shall be possible to secure these components so that lifting by wind and overturning is not possible.

Apertures in platforms shall not exceed 25 mm in width.

Where openings for access are provided within the platform area such openings shall be guarded, or shall be capable of being closed.

10.1.2 Side protection

10.1.2.1 General

Side protection components shall be incapable of removal except by direct intentional action.

It shall be possible to erect protection at platform edges comprising:

a) two guardrails;

b) a toeboard at the bottom to prevent objects rolling or being pushed off the platform;

c) sufficient obstruction of the space between the guardrail and the toeboard to reduce the risk of people and large objects falling through.

NOTE 1:
Structural requirements are given in 5.4.

NOTE 2:
A fencing structure may be provided capable of preventing objects as small as bricks from falling, and can either be combined with the guardrail and toeboard, or be an additional and separate component.

10.1.2.2 Principal guardrail

It shall be possible to fix a guardrail in such a position that its top surface is 1000 ± 50 mm above the level of the platform it is guarding (see figure 8).

10.1.2.3 Toeboard

It shall be possible to fix a solid toeboard such that its top edge is at least 150 mm above the adjacent platform level.