



SLOVENSKI STANDARD

SIST HD 1004:2000

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Mobile access and working towers made of prefabricated elements - Materials, dimensions, design loads and safety requirements

Fahrbare Arbeitsbühnen (Fahrgerüste) aus vorgefertigten Bauteilen, Werkstoffe, Gerüstbauteile, Masze, Lastannahmen und sicherheitstechnische Anforderungen

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

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HARMONIZATION DOCUMENT

HD 1004:1992

DOCUMENT D'HARMONISATION

HARMONISIERUNGSDOKUMENT

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Descriptors : Site equipment, mobile equipment, scaffolding, prefabricated elements, mechanical strength, loads, forces, design, dimensions, specifications, safety, tests

English version

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This Harmonization Document was approved by CEN on 1992-05-22. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for the implementation of this Harmonization Document on national level.

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

This Harmonization Document exists in the official versions (English, French, German).

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CEN

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

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Foreword

The development of mobile access and working towers stems from two roots:

- scaffold manufacturers placed prefabricated unanchored scaffolds on four legs and castors and
- ladder manufacturers began to construct mobile access towers with light-weight ladders using aluminium frames and castors.

Taking this into account, CEN/TC 53 decided in 1980 to standardize the manufacture of mobile access and working towers in parallel with the European standardization of prefabricated service and working scaffolds (HD 1000).

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.

According to the Common CEN/CENELEC Rules the following countries are bound to implement this Harmonisation Document:

Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxemburg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

This Harmonization Document applies to the design and manufacture of mobile access and working towers made of prefabricated elements with a height from 2,5 m to 12,0 m (indoors) and from 2,5 m to 8,0 m (outdoors).

- does not apply to towers already in use prior to the date of implementing this Harmonization Document.

- does not specify properties for the materials used.

NOTE:

In this Harmonization Document 'indoors' means that the towers will not be exposed to wind.

2 Normative references

This Harmonization Document 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 Harmonization Document only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

HD 1000:1988 Service and working scaffolds made of prefabricated elements - Materials, dimensions, design loads and safety requirements

This Harmonization Document

- gives guidelines for the choice of the main dimensions and stabilizing methods,
- gives safety requirements and
- gives some information on complete towers and their manual relocation.

NOTE:

This Harmonization Document:

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:

Some countries require A-deviations as given in the National Annexes.

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

3 Definitions

For the purpose of this Harmonization Document the following definitions apply:

3.1 Mobile access and working towers

Mobile access and working towers are scaffold structures which

- are assembled using prefabricated components
- are capable of being moved manually on firm, level ground
- have the dimensions fixed by the design
- are capable of being used free-standing
- have one or more working platforms

and normally

- have four legs and at least four castors

3.2 Height

Height h is the distance from the ground to the upper surface of the topmost platform.

3.3 Castor wheel

A castor wheel is a swivelling wheel secured to the base of a member to enable the tower to move.

3.4 Adjustable leg

An adjustable leg is a leg incorporated into the structure for plumbing a tower when situated on uneven or sloping ground. An adjustable leg may be fitted with either a castor wheel or a base plate.

3.5 Base plate

A base plate is a plate with a spigot or socket for distributing the load from a vertical tube or adjustable leg or other load-bearing tube.

3.6 Decking component

A decking component is a unit of decking that supports a load on its own.

3.7 Bracing member

A bracing member is a member placed diagonally with respect to the vertical or horizontal members of a tower and fixed to them to provide stiffness.

3.8 Outrigger

An outrigger is a component that increases the effective base dimensions of a tower, with provision for the attachment of a castor.

3.9 Stabilizer

A stabilizer is a component that increases the effective base dimensions of a tower, without provision for the attachment of a castor.

3.10 Ballast

Ballast consists of weights placed at the base of the tower to increase its resistance to overturning.

3.11 Stairway

A stairway is a means of access intended:

- to be used frequently
- also for persons carrying tools.

3.12 Stairladder

A stairladder is a means of access intended:

- to be used less frequently
- not for persons carrying tools (other than light tools such as screwdriver, paint brush or tape measure).

3.13 Horizontal frame

A horizontal frame is a component which provides a continuous horizontal stiff plane.

3.14 Vertical frame

A vertical frame is a component which provides a continuous vertical stiff plane.

3.15 Platform

A platform is one or more decking components forming a working area.

3.16 Standard

A standard is a vertical or nearly vertical member.

3.17 Length

The length l is the greater of the two plane dimensions at platform level.

4 Dimensions

The minimum width of the platform shall be 600 mm and the minimum length shall be 1000 mm.

NOTE:

600 mm is a minimum width for work mainly in an upright position. For work in other positions and depending on the nature of obstacles (storage) and tools the platform should be wider than the minimum.

The minimum clear height between platforms shall be 1,90 m. The minimum clear height between platforms and the supporting construction of the platform above shall not be less than 1,75 m.

5 Materials

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

Materials shall comply with the standards given in the National Annexes.

6 Design requirements

6.1 General

The following subclauses specify the minimum requirements for structural strength for the mobile access and working tower including platforms, and for safety during relocation. All service loads are taken to be static loads.

6.2 Design loads

6.2.1 Tower selfweight as given by the manufacturer

6.2.2 Vertical service loads:

6.2.2.1 Uniformly distributed load on platform¹⁾

- class 2: 1,5 kN/m²
- class 3: 2,0 kN/m²

6.2.2.2 Concentrated loads in the most unfavourable position on a platform area of

- 500 mm x 500 mm 1,5 kN
- 200 mm x 200 mm 1,0 kN

6.2.2.3 Minimum vertical service load on the structure, equally distributed on 4 legs

5,0 kN

6.2.3 Horizontal service load

On the level of the topmost platform with length l:

- 6.2.3.1 $l \leq 4,0$ m 0,3 kN
- 6.2.3.2 $l > 4,0$ m $2 \times 0,3$ kN

6.2.4 Horizontal design load to simulate wind

0,1 kN/m² multiplied by the appropriate shape factors, see HD 1000:1988

6.2.5 Load resulting from an inclination of 1%.

Vertical loads to be taken into consideration are:

6.2.5.1 Selfweight as given (see 6.2.1)

6.2.5.2 Vertical service load as given (see 6.2.2)

6.3 Strength of complete tower structure

A tower structure shall be strong enough to resist the combination of loads, taking one line from each of the five groups given in table 1, in its worst combination.

Eccentricities of castor wheels have to be taken into account.

A tower shall withstand all loads induced in it during erection and dismantling in accordance with the manufacturer's instructions.

It shall be possible to fix platforms for erection and dismantling purposes with vertical distances between platforms not exceeding 2,10 m.

6.4 Platform

6.4.1 Platforms shall be assessed with respect to selfweight and the most unfavourable service load according to table 2.

6.4.2 When subjected to the concentrated load specified in table 2 line 1.2 the maximum deflection of any decking component shall not exceed 1/100th of the span of that decking component.

In addition, in the case of decking components with spans of 2 m or greater, the maximum deflection difference of loaded and unloaded decking components shall not exceed 20 mm.

6.5 Guardrails

A guardrail, regardless of its span, shall withstand separately (see table 2):

- a) a point load of 0,3 kN with an elastic deflection of not 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 unfavourable positions and at any horizontal or downward angle.

6.6 Lateral movement

The base of the tower shall be stiff in the horizontal plane to allow relocation. This shall include outriggers and stabilizers where appropriate.

¹⁾ These class numbers are in accordance with HD 1000:1988, table 1.

Table 1: Design loads on the whole structure

Group	Line	Kind of load	Value for load	Subclause
1		selfweight including ballast if applicable	as given	6.2.1
2		vertical service load		
	2.1	uniformly distributed		
	2.1.1	for class 2	1,5 kN/m ²	6.2.2.1
	2.1.2	for class 3	2,0 kN/m ²	6.2.2.1
	2.2	minimum vertical service load on structure	5,0 kN/4 legs	6.2.2.3
3		horizontal service load on level of the uppermost platform		
	3.1	l ≤ 4,0 m	0,3 kN	6.2.3.1
	3.2	l > 4,0 m	2 x 0,3 kN	6.2.3.2
4		horizontal design load to simulate wind	0,1 kN/m ²	6.2.4
5		loads resulting from an inclined position of 1%		6.2.5
where: 1 length of the platform				

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7 Components

7.1 Castor wheels

7.1.1 General

Castor wheels shall be fixed to the tower in such a way that they cannot be accidentally detached.

7.1.2 Brakes

All castors shall have wheel brakes. They shall have swivel brakes unless by their design they are not eccentric when locked.

The brake mechanism shall be designed in such a way that it can only be unlocked by a deliberate action. The brake mechanism must effectively prevent any rotation of the wheel when a horizontal force of 0,30 kN is applied through the vertical swivel axis of the castor as close as possible above the castor housing and in the rolling direction of the castor. The full value of the specified service load is to be taken into account when testing the castor brakes.

7.1.3 Design load

The maximum design load of castors given by the manufacturer shall be verified by a minimum of 5 control tests.

The test load shall be 3 times the maximum design load derived from table 1. One line is taken from each of the five groups in table 1 to establish the maximum design load.

The brakes being locked, an initial vertical load of 0,50 kN is to be applied, the plate of the fork being taken as the origin for measurements of vertical displacement d_c .

The load shall be increased and the vertical deformation d_c shall be measured. The load shall be returned to 0,50 kN. After 30 minutes the residual deformation d_r shall be measured.

The control test shall meet both of the following requirements:

- residual deformation after 30 minutes shall not be more than 1,5 mm
- total deformation d_r not more than 15 mm.

The maximum design load is verified if all 5 control tests meet the test requirements.

Table 2: Design loads on parts of the structure

Line	Element	Kind of load	Value for load	Subclause
1	platform			
1.1		uniformly distributed on the whole area		6.2.2.1
1.1.1		class 2	1,5 kN/m ²	6.2.2.1
1.1.2		class 3	2,0 kN/m ²	6.2.2.1
1.2		concentrated on an area of 500 x 500 mm in the most unfavourable position on the platform	1,5 kN	6.2.2.2
1.3		concentrated on an area of 200 x 200 mm in the most unfavourable position on the platform	1,0 kN	6.2.2.2
2	guardrail			
2.1		a point load on the guardrail in the most unfavourable position	0,3 kN	6.5 a)
2.2		a point load on the guardrail in the most unfavourable position	1,25 kN	6.5 b)

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7.1.4 Wheels

Wheels shall be of punctureless type and suitable for their designed use.

7.2 Means for stabilizing

7.2.1 Stabilizers and outriggers

The stabilizers and outriggers of a tower shall be designed as integral parts of the main structure and shall provide means of adjustment to ensure contact with the ground.

The method of fixing the stabilizer or outrigger to the tower shall have adequate strength and shall be such that the loads in the stabilizer or outrigger are transferred to the tower without slip, rotation or other movement of the stabilizer or outrigger.

7.2.2 Ballast

If ballast is necessary it shall be securely positioned and made of rigid materials such as steel or concrete, but excluding liquids or granular materials.

7.3 Connections

7.3.1 General

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

7.3.2 Vertical spigot and socket connection

When assembled, the horizontal movement (slack or play) between upper and lower components shall not exceed 4 mm or a movement away from the centre line of 2 mm.

In all cases it shall not be possible to disconnect an upper component laterally until the upper component has been lifted more than 80 mm.

When the spigot and socket connection acts over a distance less than 150 mm the connection shall be provided with a positive locking device, such as a cross pin, to prevent the upper component from being lifted unintentionally.

NOTE:

The captive locking device shall be placed in such a way that its positive action can be monitored visually.

7.3.3 Other vertical connections

There shall be equivalent provisions related to 7.3.2 to limit the risk of accidental disconnections.

NOTE:

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

7.3.4 Assessment of joints and connections

The strength of joints and connections (e.g. welded joints, compressed connections, hollow-type rivet connections) shall be verified by calculation or by test.

In the latter case three tests shall be carried out on each type of joint in each of which it shall be verified that the joint is capable of withstanding without collapse three times the greatest working stress in the components.

7.4 Access to platforms

7.4.1 General requirements

Access to the platforms in an assembled tower shall be provided by a stairway, a staitladder or an inclined or vertical ladder contained within the main structural supports. They shall:

- be secured against unintentional loosening
- not rest on the ground
- have a distance from the ground to the first step or rung of 400 mm maximum (if the first step is a platform, 600 mm may be allowable)
- have steps/rungs with constant spacing and a slip resistant surface.

From the front edge of the step or from the centre of the rung to any obstacle behind the stairway/ladder there shall be a horizontal distance of $s = 150$ mm minimum (s given in figure 3).

The minimum clear height for access measured between the steps or rungs and the supporting structure of the platform above shall not be less than 1,75 m.

Access to a working platform through an aperture in a platform shall be provided with means to prevent falling through.

The aperture shall be as small as practicable, but it shall have a minimum clear opening of:

0,40 m wide x 0,60 m long.

7.4.2 Stairway and stairladder requirements

Stairways and stairladders are means of access to working platforms, which enable persons to ascend and descend facing forwards.

The outside of stair flights shall be provided with a handrail which runs approximately parallel to the stairs. Where a flight of stairs is provided in a continuous dog-leg style, a handrail shall be also provided on the inside. Where there are flights of stairs interrupted by platforms at ≤ 2 m intervals the inside handrail may be omitted.

Flights of stairs in a continuous dog-leg style shall have landings. Each of these stairs shall have a minimum of one landing and this shall have a minimum length of 300 mm.

7.4.2.1 Stairway requirements (see figure 1)

- Inclination $35^\circ \leq \alpha \leq 55^\circ$
- Vertical step rise $t = 190$ mm minimum to 250 mm maximum
- Minimum step depth $d = 125$ mm
- Minimum clear width 400 mm
- Horizontal gap between steps $0 \leq g \leq 50$ mm

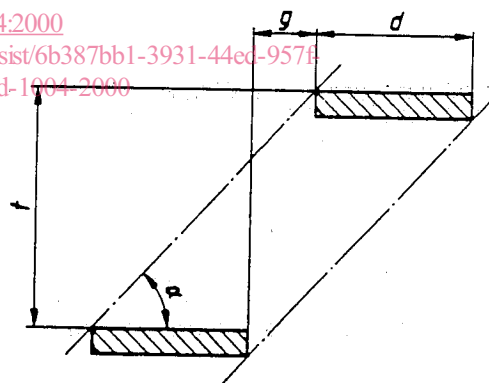


Figure 1: Stairway dimensions

7.4.2.2 Stairladder requirements (see figure 2)

- Inclination $35^\circ \leq \alpha \leq 55^\circ$
- Vertical step rise $t = 150$ mm minimum to 250 mm maximum
- Minimum step depth $d = 80$ mm
- Minimum clear width 280 mm
- Horizontal gap between steps $0 \leq g \leq 200$ mm

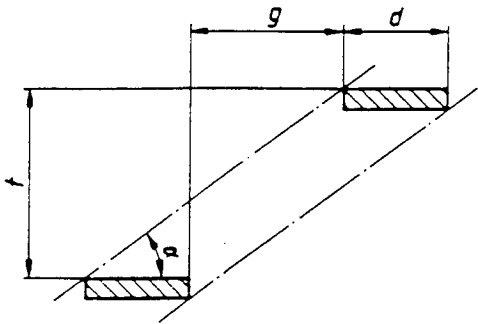


Figure 2: Stairladder dimensions

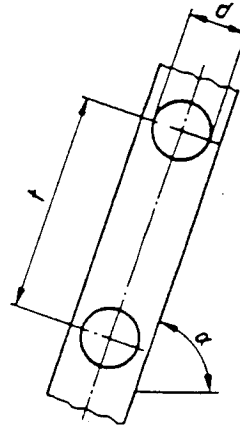


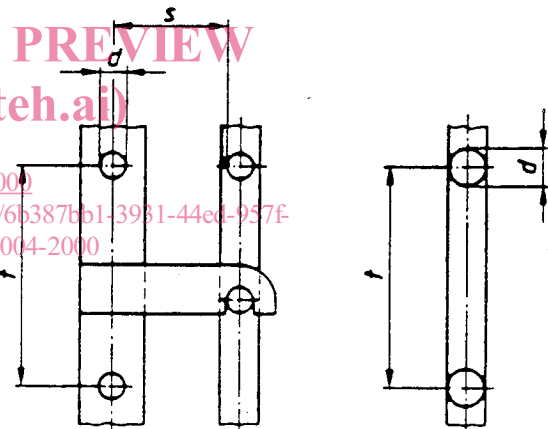
Figure 3: Inclined ladder dimensions

7.4.3 Inclined ladder requirements (see figure 3)

- Inclination $60^\circ \leq \alpha \leq 75^\circ$
- Step spacing $230 \text{ mm} \leq t \leq 300 \text{ mm}$
- Step depth $d > 80 \text{ mm}$
- Rung spacing $250 \text{ mm} \leq t \leq 300 \text{ mm}$
- Rung depth $20 \text{ mm} \leq d \leq 80 \text{ mm}$
- Minimum clear width 280 mm
- Maximum vertical distance between different platforms 4,0 m
- Maximum distance between the ground and the first platform 4,4 m

7.4.4 Vertical ladder requirements (see figure 4)

- Rung spacing $230 \text{ mm} \leq t \leq 300 \text{ mm}$
- Rung depth or diameter $20 \text{ mm} \leq d \leq 51 \text{ mm}$
- Minimum clear width 280 mm
- Maximum vertical distance between different platforms 4,0 m
- Maximum distance between the ground and the first platform 4,4 m



4a) separate ladder 4b) integral ladder

Figure 4: Vertical ladder dimensions

7.5 Working levels

7.5.1 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.

NOTE:

Certain national regulations do not permit gaps as big as this in certain applications.

This does not apply to apertures like hand holes in hatches.

7.5.2 Side protection

See figure 5 for allowable dimensions.

Dimensions in mm

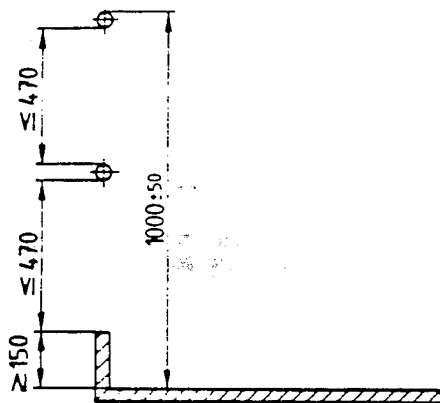


Figure 5: Side protection dimensions

7.5.2.1 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:

- two guardrails;
- toe board at the bottom to prevent objects rolling or being pushed off the platform;
- sufficient obstruction of the space between these to minimize the risk of people and large objects falling through.

NOTE:

A fencing structure can be provided capable of preventing objects as small as bricks from falling and may be combined with guardrail and toe board or can be an additional and separate component.

7.5.2.2 Handrail

It shall be possible to fix a handrail in such a position that its top surface is $1000 + 50$ mm above the level of the platform (see figure 5).

7.5.2.3 Intermediate guardrail

It shall be possible to fix a second guardrail, such that neither the space above and between it and the underside of the principal guardrail nor the space below and between it and the top of the toe board exceed 470 mm.

7.5.2.4 Toe board

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

7.5.2.5 Fencing structures

When a fencing structure is provided, the aperture size shall not exceed 100 mm x 100 mm.

8 Assessment

8.1 General

The assessment shall be made by tests and/or by calculations in accordance with EUROCODE 3.

Pending the publication of EUROCODE 3 and other relevant European Standards, calculations shall be carried out in accordance with National Standards given in the National Annexes.

8.2 Assessment of stresses

For the assessment of stresses in the materials of the tower, the service loads are working loads and design shall be in accordance with National Standards given in the National Annexes using calculation methods with permissible stress or load factors.

8.3 Resistance to overturning

Mobile access towers shall be designed with a safety factor against overturning of 1,5.

The calculation of the windload shall be in accordance with HD 1000:1988, 5.3.2.2 and 5.3.2.3.

The following loads from table 1 are applicable:

8.3.1 Vertical loads

- self weight
- vertical service load on a position of 100 mm from the most unfavourable edge of the upmost platform. The vertical service load to be taken into account is:

- for platform length ≤ 4 m:	0,75 kN
- for platform length > 4 m:	2 x 0,75 kN

8.3.2 Horizontal loads

- horizontal service load on the top platform. The horizontal service load to be taken into account is:

- for platform length ≤ 4 m:	0,3 kN
- for platform length > 4 m:	2 x 0,3 kN
- windload $0,1 \text{ kN/m}^2$ on structure and persons

- for platform length ≤ 4 m:	1 person
- for platform length > 4 m:	2 persons.