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Technical Committee CSB/57
Scaffolding and temporary access

DRAFT HARMONISATION DOCUMENT
MOBILE ACCESS AND WORKING TOWERS MADE OF PREFABRICATED ELEMENTS, MATERIALS, DIMENSIONS, DESIGN LOADS AND SAFETY REQUIREMENTS

This draft is now available for public comment and your views and technical comments on it would be appreciated. If you have no specific comments to make but find it generally acceptable it would be helpful if you would notify us accordingly. Suggestions entailing revision of the text should indicate the preferred wording. Please quote the relevant clause number against any comment.

The co-ordination of the requirements of this draft with those of any related standards is of particular importance and you are invited to point out any areas where this may be necessary.

All comments should be sent to the Committee Secretary Mr F C Rattue Frank Inness.
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DRAFT HARMONISATION
MOBILE ACCESS AND WORKING TOWERS MADE OF PREFABRICATED ELEMENTS; MATERIALS DIMENSIONS, DESIGN LOADS AND SAFETY REQUIREMENTS

Secretary's Note. This draft HD is based on discussion between CEN members, in which the UK has taken an active part. However, technical comment on this proposal will greatly asisst further participation by the UK in this work.

The UK have a commitment to implement this document if it receives sufficient support from CEN/TC 53 therefore it is essential that comments are made available for negotiation in CEN.

Attention is drawn to Clause 7.4 'Access to platforms'. It is felt that some of the requirements may be unacceptable to UK industry.

HARMONIZATION DOCUMENT

DOCUMENT D'HARMONISATION

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prHD 1004

May 1989

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Key words:

English version

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

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

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

This draft Harmonization Document has been drawn up by the Technical Commitee of CEN/TC 53. It is submitted to the CEN members for public enquiry.

If this draft becomes a Harmonization Document, CEN members are bound to comply with the requirements of the CEN Internal Regulations which stipulate the conditions for giving this Harmonization Document a national level without any alteration.

This draft Harmonization Document was established by CEN 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 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

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.

In accordance with the Common CEN/CENELEC Rules, the following countries are bound to implement this European Standard:

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1 Object and field of application

This Harmonization Document applies to the design and manufacture[1]) 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).

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

This Harmonization Document

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

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

[1]) This document does not give information on requirements for lateral stability and reference should be made to national documents. See also annex C.

2 References to other standards

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

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

NOTE:
From the date of completion of this European Standard 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

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, when assembled to their maximum height
- have the dimensions fixed by the design
- are capable of being used standing freely
- 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.

3.5 Base plate

A base plate is a metal plate with a spigot or socket for distributing the load from a raker or other load-bearing tube.

3.6 Adjustable base plate

An adjustable base plate is a base plate incorporating a screwjack.

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 castors.

3.9 Stabilizer

A stabilizer is a component which may have self-adjusting feet, that increases the effective base dimensions of a tower.

3.10 Ballast

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

3.11 Internal access

A means of providing access to the working platforms located inside the perimeter of the tower, for example a stairway, or an inclined or vertical ladder.

3.12 Horizontal frame

A component which provides a continuous horizontal stiff plane.

3.13 Vertical frame

A component which provides a continuous vertical stiff plane.

3.14 Platform

One or more decking components forming a working aera.

3.15 Standard

A vertical (or nearly vertical) member.

3.16 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 distance between upper surfaces of superjacent platforms shall be 2,0 m.

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5 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.

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 Selfweight as given by the manufacturer

6.2.2 Vertical service loads:

6.2.2.1 Uniformly distributed load on platform[2]):

- class 2: 1,5 kN/m^2
- class 3: 2,0 kN/m^2

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

5,0 kN / 4 legs

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 x 0,3 kN

6.2.4 Horizontal design load to simulate wind 0,1 kN/m^2 multiplied by the appropriate shape factors, see HD 1000:1988

6.2.5 Load resulting from an inclination of 1%. This does not take into account loads from secondary effects. 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)

---

[2]) This is in accordance with HD 1000:1988.

6.3 Load cases

6.3.1 Complete tower structure

A tower structure shall be capable of resisting the worst combination of loads, taking one line from each of the five groups given in table 1.

6.3.2 Castor wheels

Eccentricities of castor wheels have to be taken into account.

6.3.3 Erection and dismantling

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

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 vertical loads according to table 2, the maximum deflection of any decking component shall not exceed 1/100 of its span.

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.

6.7 Assessment of stresses

For the assessment of stresses in the materials of the tower, the loads are working loads and design shall be in accordance with national standards given in the national annexes, using permissible working stresses or load factor methods.

Table 1. Design loads on the whole structure

Group	Line	Kind of load	Value for load	Subclause
1	1	selfweight	as given	6.2.1
2	2	vertical service load		
	2.1	uniformly distributed		
	2.1.1	class 2	1,5 kN/m²	6.2.2.1
	2.1.2	class 3	2,0 kN/m²	6.2.2.1
	2.2	minimum vertical service load on structure	5,0 kN/4 legs	6.2.2.3
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	4	horizontal design load to simulate wind	0,1 kN/m²	6.2.4
5	5	loads resulting from an inclined position of 1 %:		
	5.1	selfweight	as given	6.2.5.1
	5.2	vertical service load	as given	6.2.5.2

where:

l length of the platform

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 300 N 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 Working load

The maximum working load of castors shall be verified by test and shall be not more than 1/3 of the failure load.

The brakes being locked, an initial vertical load of 500 N is to be applied lowering the plate of the fork taken as the origin for measurements of vertical displacement d_c.

The load is to be increased in stages of 500 N and the vertical deformation d_c is to be measured; after each stage the load is to be returned to 500 N and the residual deformation d_r is to be measured.

Move to test annex

Table 2. Design loads on parts of the structure

Line	Element	Kind of load	Value for load	Subclause
1	platform			
1.1		concentrated on an area of 500 x 500 mm in the most unfavourable position on the platform	1,5 kN	6.2.2.2
1.2		concentrated on an area of 200 x 200 mm in the most unfavourable position on the platform	1,0 kN	6.2.2.2
1.3		uniformly distributed on the whole area		6.2.2.1
1.3.1		class 2	1,5 kN	6.2.2.2
1.3.2		class 3	2,0 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)

1.5 kN/m²
2.0 kN/m²

The failure load is the lower value of either

- the load giving a permanent residual deformation of 1,5 mm or
- the load giving a total deformation of 15 mm.

7.1.4 Wheels

Wheels shall be of punctureless type.

7.2 Means for Stabilizing

7.2.1 Stabilizers and Outriggers

The stabilizers and outriggers of a tower 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.

The stabilizers or outriggers shall be designed as integral parts of the main structure. The loading of the stabilizers or outriggers therefore follows from the loading-combinations, on the understanding that:

- the projecting parts, transmitting the loads to the ground (castors, adjustable supports) shall be designed to accord with the requirements for the castors
- from horizontal forces shall be supposed that they may act in all directions
- hinges and other fastening parts of the stabilizers or outriggers are designed or tested to 3 times the greatest working stress.

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 powdery materials.

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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 and and 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 has to be provided with a positive locking device, such as a cross pin, to secure the upper component to be lifted off 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 HD 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 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 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 150 mm minimum.

The minimum clear height for access measured between its platforms and transoms supporting the superjacent upper platform as well as the minimum clear headroom on ladders and stairs shall not be less than 1,8 m.

Access to a working platform through an aperture in a platform shall be provided with means to prevent falling through, e.g. a hatch door or a guardrail.

The aperture shall be as small as practicable, but it shall have a minimum clear opening of 0,4 m x 0,6 m.

NOTE:
The access means shall be designed to preclude their use as portable access means outside the tower unless they also satisfy current legal regulations.

7.4.2 Stairway requirements (see figure 1)

- Inclination	$35° \leq \alpha \leq 50°$
- Vertical step rise	t = 190 mm minimum to 300 mm maximum
- Minimum step depth	j = 125 mm
- Minimum clear width	400 mm
- Horizontal gap between steps	g ≤ 50 mm

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. The stair shall have a minimum of one landing and this shall have a minimum length of 300 mm.

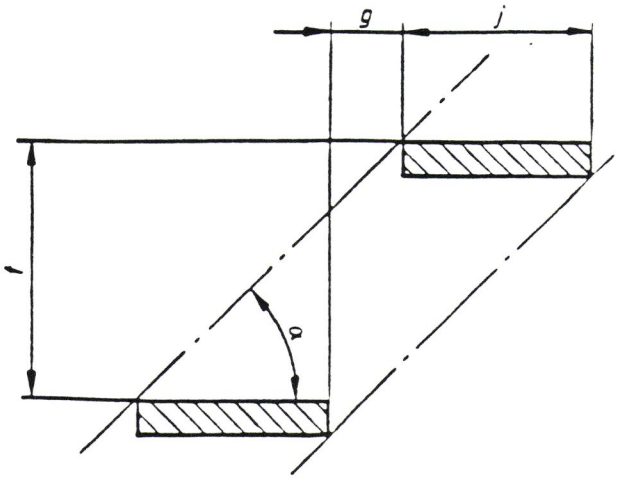


Figure 1. Stairway dimensions

7.4.3 Inclined ladder requirements (see figure 2)

- Inclination	$65° \leq \alpha \leq 75°$
- Step spacing	$230 \text{ mm} \leq t_1 \leq 300 \text{ mm}$
- Rung spacing	$250 \text{ mm} \leq t_2 \leq 300 \text{ mm}$
- Rung or step size	$20 \text{ mm} \leq j \leq 90 \text{ mm}$
- Minimum clear width	300 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 3)

- Rung spacing	$230 \text{ mm} \leq t_1 \leq 300 \text{ mm}$
- Rung diameter	$20 \text{ mm} \leq d \leq 50 \text{ mm}$
- Minimum clear width	300 mm
- Maximum vertical distance between different platforms	4,0 m
- Maximum distance between the ground and the first platform	4,4 m

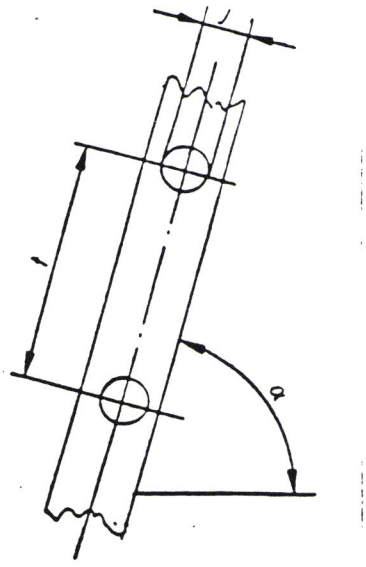
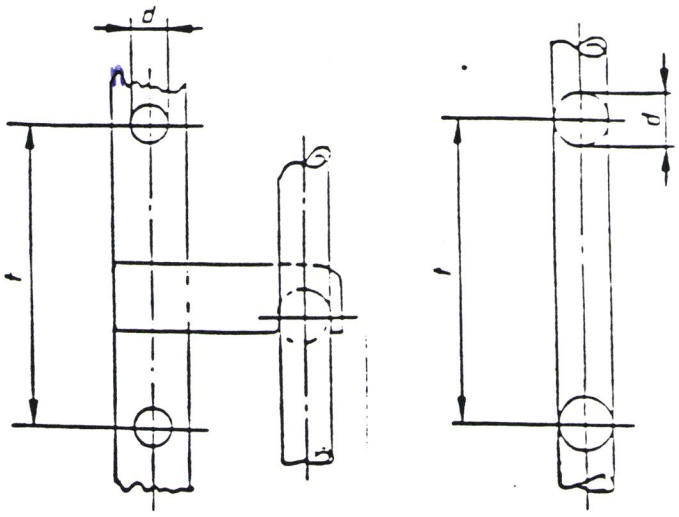


Figure 2. Inclined ladder dimensions



3a) separate ladder 3b) integral ladder

Figure 3. 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[3]). This does not apply to apertures like hand holes in hatches.

[3]) Certain national regulations do not permit gaps as big as this in certain applications.

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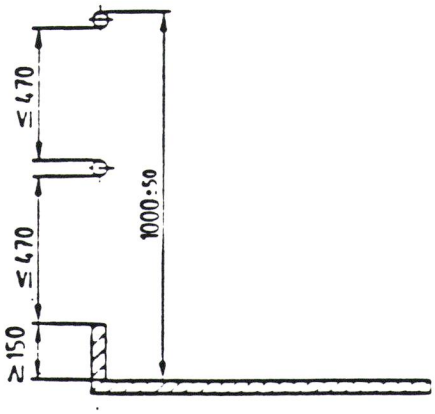
7.5.2 Side protection

See figure 4.



Dimensions in mm

Figure 4. 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:

a) two guardrails;

b) a toe board at the bottom to prevent objects rolling or being pushed off the platform.

c) 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 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 4).

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

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

Calculations shall be carried out in accordance with national standards given in the national Annexes.

9 Data to be supplied by the manufacturer

9.1 Particular data

The manufacturer shall supply the user with the following data:

a) Name and address of the manufacturer or supplier

b) class of the scaffold in accordance with the permitted loading. Number of platforms which may be loaded

c) permitted heights in metres for different conditions, if appropriate

d) weight and basic dimensions of components

e) data on the ballasting required to achieve the necessary resistance to overturning and instructions to fix the ballast securely

f) maximum permissible ballast loading

g) instructions for the erection and dismantling of the tower including identification of components required for this purpose

h) instructions regarding the maintenance of components whilst in use and in storage but excluding instructions on the repair of damaged equipment

i) areas perpendicular to the wind and the appropriate aerodynamic shape factor for each.

9.2 Recommendations for the use of mobile access and working towers

The manufacturer shall make available for the user a copy of the information given in annex C.

10 EN Designation

The following data are required for the EN designation of all prefabricated mobile access and working towers:

- class of uniformly distributed load

- maximum height outdoors/indoors.

The designation of a prefabricated mobile access and working tower, e.g.

- class 2,

- maximum height indoors 12 m, outdoors 8 m

shall be:

TOWER EN 00 000 - 2 - 8/12

11 Marking

A means of identification, e.g. a manufacturer's plate showing the information below, shall be displayed at eye level and in a place where it is clearly visible on all mobile access and working towers:

- Manufacturer's mark

- Year of manufacture

- Designation in accordance with clause 10

- "Instructions for erection and use to be followed carefully".

12 Verification tests of overall structure and stiffness

Tests shall be carried out in accordance with annexes A and B and the results shall be in conformity with the respective annexes.

Annex A

Load tests on a complete tower structure (obligatory)

A.1 Test - Requirements

Complete tower structures shall be tested under a combination of vertical and horizontal loads as described below. The assembly shall support these loads without collapse or significant permanent deformation.

A.2 Test structure - Towers up to 12,0 m high

For towers which are intended to be built to a height of up to 12,0 m (ground to working platform level) these tests shall be carried out on a test structure approximately 6,0 m high. For towers limited by design of heights of less than 6,0 m the tests shall be conducted at the maximum designed height of the tower.

The tower shall be built in accordance with the manufacturers instructions.

Castor wheels shall be turned to be in their most unfavourable orientation and locked; adjustable legs shall be extended to their maximum extension.

If the design of the tower calls for the use of outriggers, stabilizers or ballast, the test shall be done with these respective components attached.

A.3 Loads

The test loads shall be based on the most unfavourable working loads as follows:

Vertical loads:

the greater of

either a) Platform area times the prescribed uniformly distributed load

or b) 5,0 kN on 4 legs.

The test load shall be 2,5 times greater than a) or b).

Horizontal loads:

The test load shall be 300 N times the multiplying factor of 2,5. i.e. 750 N. It shall be applied at the first convenient node point above 6,0 m and may be adjusted to give equivalent moments about the base level of the tower because of this.

NOTE:
The requirement to include adjustable base plates or castor wheels will often mean that the first convenient node point for the application of horizontal loads is at about 6,5 m above the ground level. For this case the horizontal load would be reduced by the ratio of 6,0/6,5 i.e. 0,923 x 750 N = 692 N.

Application of loads:

Vertical and horizontal load combination:

Vertical loads shall be applied so as to load the legs of the tower uniformly. Horizontal loads shall be applied in a direction parallel to the shortest side of the tower and acting through the centroid of the horizontal plane.

A.4 Number of tests

One test on each configuration of tower is required. However, if a range of tower designs have common features such as identical end frames, then only one test need be conducted on that range. This test will be on that configuration assessed to have the least strength.

Annex B

Stiffness tests on a complete tower structure (obligatory)

B.1 General requirements

The object of the test is to ensure that towers do not exceed the maximum permitted displacement when erected to their maximum platform height and subjected to horizontal loads. This includes the elastic stiffness, plus any take up of slack or play in the structure.

B.2 Test structure

The tests shall be carried out on complete tower structures approximately 6 m high. The tower shall be built in accordance with the maunfacturers standard instructions (see note 1). Where the self weight of the structure is insufficient to prevent overturning during the test, sufficient ballast may be added to the base to prevent this.

Tests shall be carried out in the arrangement envisaged by the manufacturer, that is to say - either: with or without stabilizers
or : with or without outriggers.
As the stiffness of the tower is not affected by ballast, where ballast is the only means of stability only one test is necessary.

Adjustable legs, if fitted, shall be extended to 50 % of their maximum extension (see note 2). Castor wheels shall be turned in their most unfavourable orientation and shall be locked.

NOTE 1:
If the maximum platform height, in accordance with the manufacturer's instructions, is less than 6 m the test structure shall be erected to at least 6 m height with additional components as prescribed by the manufacturer. This extra height will enable D_1 to be measured. The stiffness should not be adversely affected.

NOTE 2:
As adjustable legs are normally fitted to level the tower, this represents a working condition.

B.3 Method of test

The horizontal test load shall be 500 N. It shall be applied at the first convenient node point above 6,0 m level. It may be adjusted to give equivalent moments above the base level of the tower because of this (see annex A.3).

The load shall be applied perpendicular to one face of the tower and acting through the centroid. The load shall be applied in one direction and then the opposite direction, and the total displacement D_1 (in mm) shall be measured at the exact height of 6 m (see figure 5).

This test is repeated at 90 ° to the first face (see figure 5).

B.4 Result of test (see figure 6)

The total displacement measured as described in the above test shall be correlated by linear calculation to give a value of displacement D_2 for the maximum permitted platform height of the tower, with or without stabilizers, outriggers or ballast. This total displacement D_2 shall not exceed 200 mm and may limit the maximum platform height.

The maximum height of platform, limited by stiffness, is given by:

$$h_1 = \frac{6 \cdot D_2}{D_1} = \frac{6 \cdot 200}{D_1} \text{ metres}$$

NOTE:
The measured value, D_1, enables the limit of height to be calculated. For example:

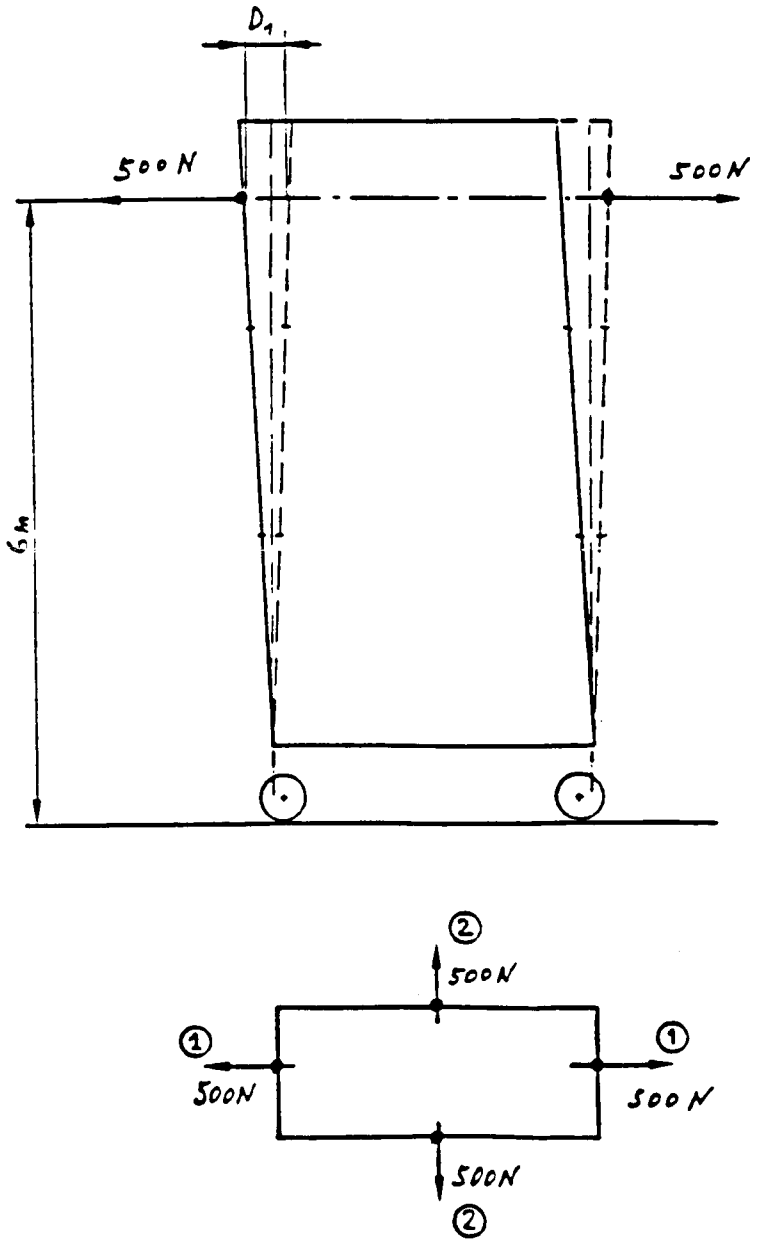
a) If the measured value D_1 is 100 mm, then from the formula

$$h_1 = \frac{6 \text{ m} \cdot 200}{100}$$

the maximum platform height h_1 = 12 m.

b) If the measured value D_1 is 300 mm, then the maximum permitted platform height h_1 = 4 m.

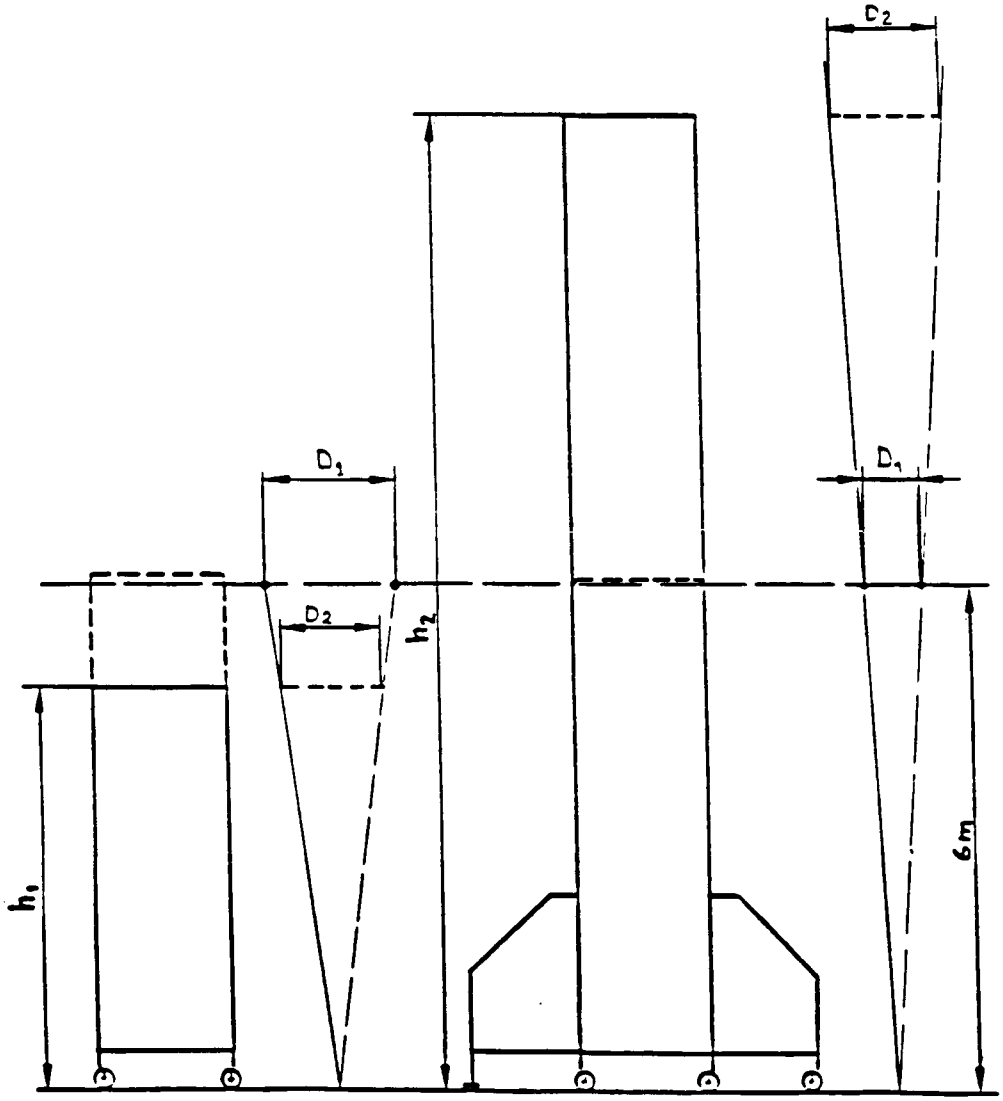
The linear formula is not precisely correct but over the range of towers that this standard covers, calculations and practical tests have shown that a linear relationship is acceptable.



1) First test in two opposite directions

2) Second test in two opposite directions

Figure 5. Horizontal loads for stiffness tests on a complete tower structure



h_1 maximum permitted height without stabilizers or outriggers

h_2 maximum permitted height with stabilizers or outriggers

D_1 measured total displacement on the test height of 6 metres

D_2 maximum permitted total displacement on the maximum permitted platform height

Figure 6. Measured and permitted displacements of towers

Annex C

Recommendations for the use of mobile access and working towers (informative)

The following points apply to all towers:

a) Mobile access and working towers may only be erected and dismantled by persons familiar with these instructions for erection and use.

b) Damaged components may not be used.

c) Only original components in accordance with the data supplied by the manufacturer shall be used.

d) The ground on which a tower is to be moved shall be capable of supporting the weight of the structure and must be flat. Its gradient may not exceed 3 %.

e) When the tower is being moved nobody may stay on it.

f) Towers shall only be moved manually and only on firm, level ground which is free from obstacles. Normal walking speed shall not be exceeded during relocation.

g) Before use, it is necessary to check, using the data given by the manufacturer for the basic version, that the tower has been erected correctly and completely and that the tower is standing perpendicularly to the ground.

h) It is not permissible to attach and use hoisting arrangements on towers unless specifically provided for by design.

i) It is not permissible to attach bridging between a tower and a building.

k) Before use, check that all necessary precautions against accidental rolling away have been taken, e.g. by applying locking brakes or using adjustable base plates.

l) It is permissible to enter and leave mobile access and working towers only by means of the internal access system.

m) It is forbidden to jump onto platforms.

n) Towers used outdoors shall, whenever possible, be secured to a building or other structure.

National annex of Germany

(CEN members are invited to attach their national annexes to the ballot form of preliminary vote.)