
Elevating work platforms — Mast-climbing work platforms

Plates-formes élévatrices de personnel — Plate-formes se déplaçant le long de mât(s)



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Published in Switzerland

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 16369 was prepared by Technical Committee ISO/TC 214, *Elevating work platforms*.

This second edition cancels and replaces the first edition (ISO 16369:2000), which has been technically revised.

Introduction

This International Standard is one of a series of standards produced by ISO/TC 214 as part of its programme of work regarding standardization of terminology, ratings, general principles (technical performance requirements and risk assessment), safety requirements, test methods, maintenance and operation for elevating work platforms used to raise (elevate) and position personnel (and related work tools and materials) to a work position where a task is to be performed.

The extent to which hazards are covered is indicated in the scope of this International Standard. In addition, ISO 12100-1 and ISO 12100-2 address lifting equipment hazards which are not covered by this International Standard.

Elevating work platforms — Mast-climbing work platforms

1 Scope

This International Standard specifies particular safety requirements for mast-climbing work platforms (MCWP) which are temporarily installed and are manually or power-operated, and which are designed to be used by one or more persons from which to carry out work.

NOTE The vertical-moving components (work platforms) are also used to move those same persons and their equipment and materials to and from a single boarding point. These restrictions differentiate MCWP from builder's hoists.

This International Standard is also applicable to permanently installed MCWP.

This International Standard is applicable to work platforms which are elevated by a drive system and guided by and moved along their supporting masts, where the masts may or may not require lateral restraint from separate supporting structures.

This International Standard is applicable to any combination of the following alternatives:

- one or more masts;
- mast tied or untied;
- mast of fixed or variable length;
- masts vertical or inclined between 0° and 30° to the vertical;
- masts which are standing or hanging;
- movable or static base (chassis or base frame);
- manual or power-operated elevation;
- towed or self-powered ground travel on site, excluding road traffic regulation requirements;
- driven using electric, pneumatic, hydraulic motors or internal combustion engines.

This International Standard identifies the hazards arising during the various phases in the life of such equipment and describes methods for the elimination or reduction of these hazards and for the use of safe working practices.

This International Standard does not specify the requirements for dealing with the hazards involved in the manoeuvring, erection or dismantling, fixing or removing of any materials or equipment which are not part of the MCWP, nor does it deal with the handling of specific hazardous materials.

This International Standard does not specify the requirements for delivering persons and materials to fixed landing levels. Such equipment is referred to as lifts or hoists and is dealt with by other International Standards.

This International Standard does not apply to mobile elevating work platforms (MEWPs) in accordance with ISO 16368, suspended access equipment in accordance with EN 1808 or lifting tables in accordance with EN 1570.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4301-1, *Cranes and lifting appliances — Classification — Part 1: General*

ISO 4302, *Cranes — Wind load assessment*

ISO 6336-1, *Calculation of load capacity of spur and helical gears — Part 1: Basic principles, introduction and general influence factors*

ISO 6336-2, *Calculation of load capacity of spur and helical gears — Part 2: Calculation of surface durability (pitting)*

ISO 6336-3, *Calculation of load capacity of spur and helical gears — Part 3: Calculation of tooth bending strength*

ISO 6336-5, *Calculation of load capacity of spur and helical gears — Part 5: Strength and quality of materials*

ISO 8686-1, *Cranes — Design principles for loads and load combinations — Part 1: General*

ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles*

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13852, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*

ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

IEC 60065, *Audio, video and similar electronic apparatus — Safety requirements*

IEC 60204-1:2005, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC 60529, *Degrees of protection provided by enclosures (IP Code)*

IEC 60947-5-1:2003, *Low-voltage switchgear and controlgear — Part 5-1: Control circuit devices and switching elements — Electromechanical control circuit devices*

EN 614-1, *Safety of machinery — Ergonomic design principles — Part 1: Terminology and general principles*

EN 953, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 982, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

3 Terms and definitions

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

NOTE Elements of MCWP defined below are illustrated in Figures 1 and 2.

3.1

rated load

load for which the MCWP has been designed for normal operation, as stated in the load diagram

3.2

load diagram

notice displayed on the work platform showing the permitted number of persons and the mass and distribution of materials for the particular configuration

3.3

rated speed

vertical or horizontal speed for which the MCWP has been designed

3.4

transfer

any horizontal movement of the MCWP from one position to another on the same working site

3.5

transfer condition

configuration of the MCWP in which it is moved from one position to another on the same working site, including any limitation on the weather and the load or persons on the MCWP

3.6

transport

any movement of the MCWP outside the boundaries of the working site

3.7

transport condition

configuration of the MCWP in which it is moved outside the boundaries of the working site

EXAMPLE Road transport.

3.8

transfer [transport] interlocks

any design features on the MCWP which prevent unsafe transfer [transport]

3.9

base frame

part of the MCWP which provides support for the mast and elevating assembly

3.10

chassis

part of the MCWP which provides mobility and support for the mast and elevating assembly

3.11

rail-mounted chassis

chassis designed to transmit horizontal as well as vertical force to the ground via rails

3.12

outrigger

support at the base-frame level used to maintain or increase the stability of the MCWP within specified conditions

NOTE Outriggers can also be used for levelling.

3.13

outrigger beam

part of an outrigger assembly which moves in an essentially horizontal plane and may be powered or operated manually

3.14

mast

structure that supports and guides the platform

3.15

fixed-length mast

mast whose length cannot be varied, even by the attachment of further mast sections

3.16

variable-length mast

mast whose length can be varied by the attachment of successive lengths of prepared sections

3.17

guide

part of the mast which provides guiding for the work platform

3.18

mast tie

anchorage system used to provide lateral restraint to the mast from a building or other structure

3.19

work platform

vertical travelling part of the installation upon which the persons, equipment and materials are carried and from which work is carried out

NOTE The work platform includes the main platform and any platform extension, in contrast to the MCWP, which refers to the whole of the installation, including work platform, mast, mast ties, base and chassis.

3.20

available platform area

area of the work platform, measured at the work platform floor level

3.21

main platform

part of the work platform built up using primary structural elements

3.22

platform extension

additional part of the work platform, built up using secondary structural elements, whose support and location is dependent upon the main platform

NOTE Platform extensions are used to extend the main work platform, usually along its longitudinal working edge. They can form irregular shapes which conform with the work site. They can also extend at a level just above or below the main platform level.

3.23

multilevel work platform

two or more work platforms travelling on the same mast or an additional working level attached to and totally supported by a work platform

NOTE For illustration, see Annex B.

3.24

counter-roller

roller used to counteract the gear-meshing separation forces between a rack and pinion

3.25

automatic brake

device to decelerate and stop moving parts in case of interruption of the power supply

3.26

buffer

stop at the end of travel, comprising a resilient means of arrest using fluids, springs or similar means

3.27

overspeed

any speed above rated speed

3.28

overspeed detector

device which, when the work platform attains a predetermined speed above rated speed, causes the overspeed safety device to be applied

3.29

overspeed safety device

mechanical device for stopping and maintaining the work platform stationary on the mast in the event of overspeed

3.30

competent person

person having the practical and theoretical knowledge and the experience of a particular MCWP needed to carry out a function satisfactorily

3.31

user

user organization

person or organization having direct control over use of the MCWP

3.32

rack and pinion drive system

drive system using a gearing arrangement consisting of a cylindrical gear (pinion) which engages a linear gear (rack) attached to the mast

3.33

ratchet drive system

drive system that operates by attaching a ratcheting device to the rungs or other element of the mast in an alternating manner and elevates or lowers the platform a predefined distance

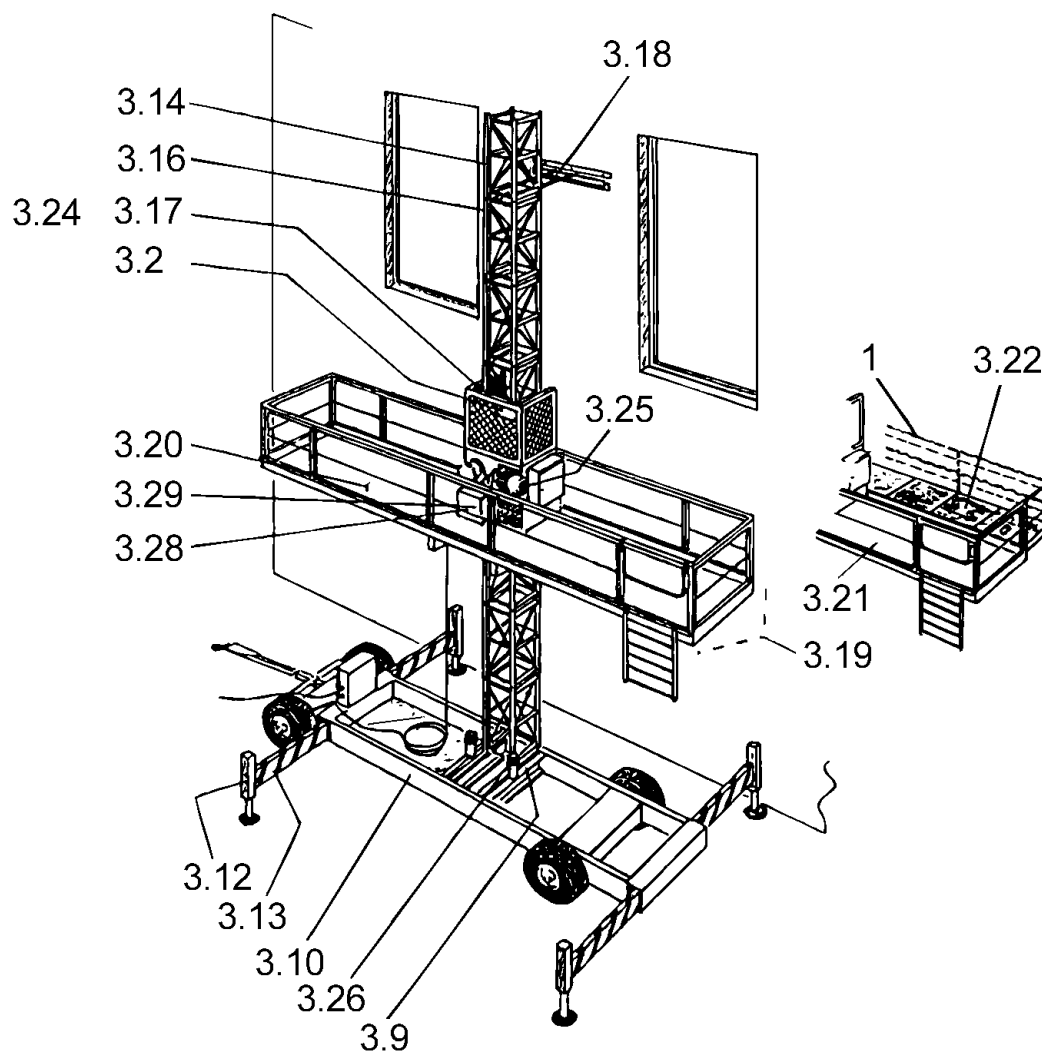
NOTE The platform can be supported by a pawl or similar device when the drive mechanism is not engaged.

3.34

screw drive system

drive system consisting of a mast-mounted rack which meshes with a powered drive screw attached to the platform

NOTE Rotation of the powered drive screw elevates or lowers the platform.

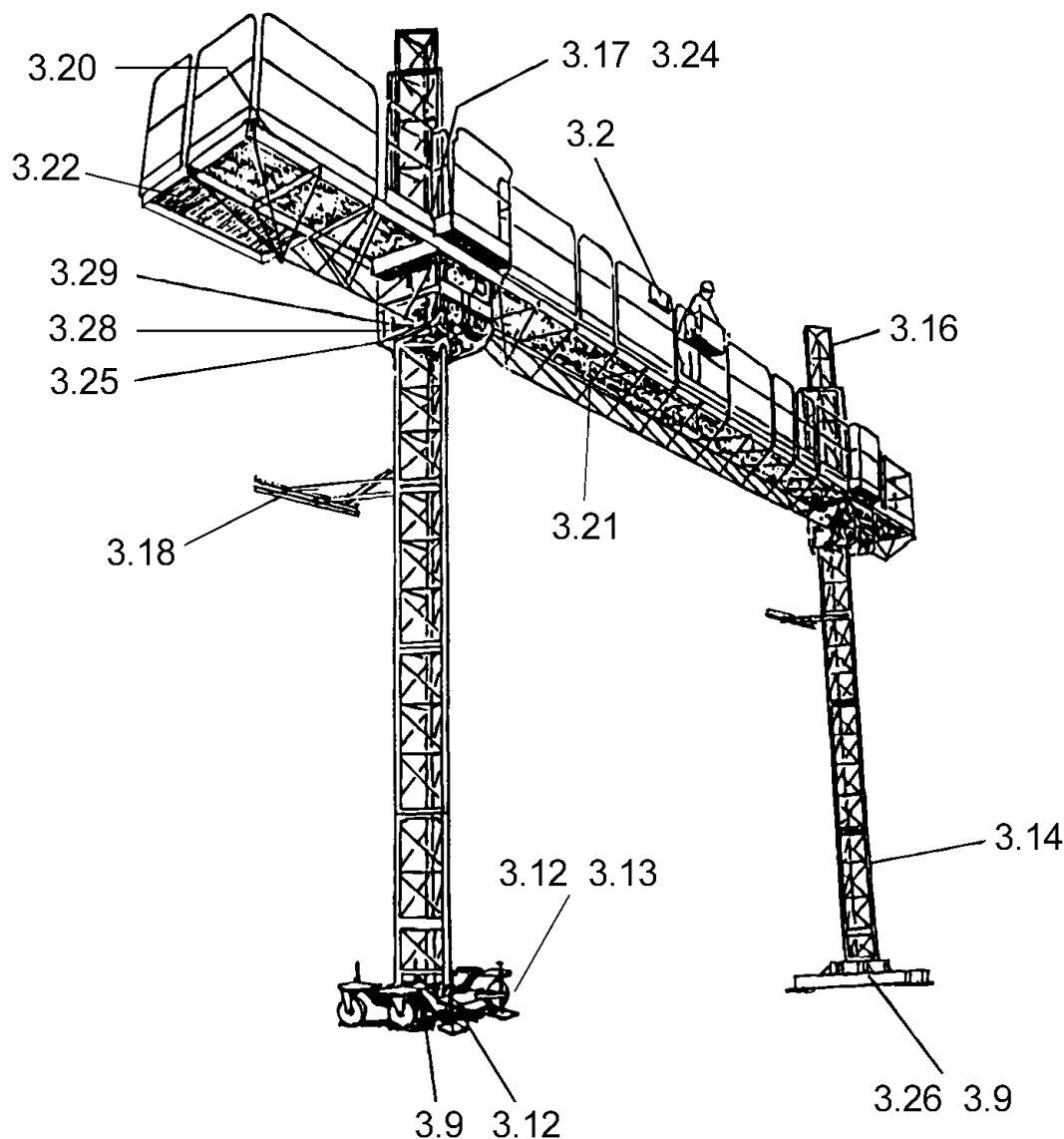


Key

1 removable handrails

NOTE Numbers correspond to terms and definitions given in Clause 3.

Figure 1 — Typical single-mast MCWP



NOTE Numbers correspond to terms and definitions given in Clause 3.

Figure 2 — Typical twin-mast MCWP

4 List of hazards

The list of hazards according to Table 1 is based on ISO 12100-1 and ISO 12100-2.

Table 1 lists the hazards which have been identified and where corresponding requirements have been formulated in this International Standard in order to limit the risk or reduce these hazards in each situation.

A hazard which is not applicable or is not significant and for which, therefore, no requirements are formulated in this International Standard, is shown in the relevant clauses column as NA (not applicable).

Table 1 — List of hazards

Hazard	Relevant clauses in this International Standard
1 Mechanical hazards	
1.1 Crushing	5.2.1.3; 5.3.2; 5.4.1
1.2 Shearing	5.2.1.3; 5.3.2; 5.4.1
1.3 Cutting or severing	5.3.2; 5.4.1
1.4 Entanglement	5.4.1
1.5 Drawing-in or trapping	5.2.1.3; 5.3.2; 5.4.1
1.6 Impact	5.4.6
1.7 Stabbing or puncture	NA
1.8 Friction or abrasion	NA
1.9 High-pressure fluid ejection	5.10.1.7; 5.10.1.8; 5.10.1.9; 5.10.1.10
1.10 Ejection of parts	5.2.1.4; 5.2.1.5
1.11 Loss of stability	5.1.5; 5.2.2.4; 5.2.2.5; 5.2.5
1.12 Slip, trip and fall	5.2.2.1; 5.3.1
2 Electrical hazards	
2.1 Electrical contact	5.8
2.2 Electrostatic phenomena	NA
2.3 Thermal radiation	NA
2.4 External influences	5.7.15, Annex B
3 Thermal hazards	
3.1 Burns and scalds from possible exposure of persons to flames or explosions and also to radiation from heat sources	5.9.1; 5.9.2; 5.9.3
3.2 Health-damaging effects of hot or cold work environment	5.9.2
4 Hazards generated by noise	Relevant but not dealt with
5 Hazards generated by vibration	5.1.2.3.2
6 Hazards generated by radiation	NA
7 Hazards generated by materials and substances processed, used or emitted by machinery	
7.1 Contact with or inhalation of harmful fluids, gases, mists, fumes and dusts	5.9.2; 5.10
7.2 Fire or explosion	5.9.3; 5.9.4
7.3 Biological and microbiological hazards	NA
8 Hazards generated by neglecting ergonomic principles in machine design	
8.1 Unhealthy postures or excessive effort	5.2.1.6; 5.2.5.2; 5.6.2; 5.13; 5.13.8
8.2 Inadequate consideration of human hand/arm or foot/leg anatomy	NA
8.3 Neglected use of personal protection equipment	5.13.8
8.4 Inadequate area lighting	7.1.2 f)
8.5 Mental overload or underload, stress	NA
8.6 Human error	5.2.2.1; 5.13

Table 1 (continued)

Hazard	Relevant clauses in this International Standard
9 Hazard combinations	5.1.1.1; 5.1.1.2; 5.1.3
10 Hazards caused by failure of energy supply, breakdown of machinery parts and other functional disorders	5.1
10.1 Failure of energy supply	5.2.2.1; 5.6; 5.8.1.2; 5.12.7
10.2 Unexpected ejection of machine parts or fluids	5.10.1.7; 5.10.1.8; 5.10.1.9; 5.10.1.10
10.3 Failure or malfunction of control system	5.2.1.5
10.4 Errors of fitting	5.1.5.1.5
10.5 Overturn, unexpected loss of machine stability	5.1.1.2; 5.1.5; 5.7
11 Hazards caused by missing and/or incorrectly positioned safety-related measures/means	
11.1 Guards	5.2.1.3; 5.3.2; 5.4.1; 5.9.1; 7.1.2 f); 7.1.2 i); 7.1.2 l); 7.2.2;
11.2 Safety-related (protection) devices	5.7
11.3 Starting and stopping devices	5.1.1; 5.12
11.4 Safety signs and signals	5.2.2.7; 7.2
11.5 Information or warning devices	7.2
11.6 Energy-supply disconnecting devices	5.2.1.2; 5.8.2.1
11.7 Emergency devices	5.5; 5.6
11.8 Means of feeding/removal of work pieces	NA
11.9 Essential equipment and accessories for safe adjustment and/or maintenance	5.2.3.1; 5.4.2.9; 5.4.3.1.2; 5.4.4.3.5
11.10 Equipment for evacuating gases	5.9.1; 5.9.2; 5.9.3
HAZARDS INVOLVING THE MOBILITY AND LOAD-LIFTING ABILITY OF MCWP	
12 Inadequate lighting of moving/working area	7.1.2 f)
13 Hazards due to sudden movement, instability, etc. during handling	5.1.5; 5.2.2.1; 5.2.2.3; 5.2.2.4; 5.4.5
14 Inadequate/non-ergonomic design of operating position	
14.1 Hazards due to dangerous environments (contact with moving parts, exhaust gases, etc.)	5.2.2; 5.9.1; 5.9.2
14.2 Inadequate visibility from operator's position	5.13.2; 5.13.5
14.3 Inadequate seat/seating	NA
14.4 Inadequate/non-ergonomic design/positioning of controls	5.13
14.5 Starting/moving of self-propelled machinery	5.13
14.6 Road traffic of self-propelled machinery	7.1.2 f)
14.7 Movement of pedestrian-controlled machinery	7.1.2 f)
15 Mechanical hazards	5.1.1.1
15.1 Hazards to persons exposed to uncontrolled movement	5.2.2.1; 5.2.4; 5.3.1.5; 5.4.1; 7.1.2 f)
15.2 Hazards due to break-up and/or ejection of parts	5.2.1.4; 5.2.1.5; 5.2.2.3
15.3 Hazards due to rolling over (ROPS)	5.1.5
15.4 Hazards due to falling objects (FOPS)	7.1.2 f)

Table 1 (continued)

Hazard	Relevant clauses in this International Standard
15.5 Inadequate means of access	5.3.3; 5.3.4
15.6 Hazards due to towing, coupling, connecting, transmission, etc.	5.2.2.6
15.7 Hazards due to batteries, fire, emissions, etc.	5.9.2; 5.9.3; 5.9.5
16 Hazards due to lifting operations	
16.1 Lack of stability	5.1.5; 5.1.1.2; 5.2.2.4; 5.2.2.5; 5.2.5.1
16.2 Derailment of machinery	5.2.2.4; 5.4.1.5; 5.4.2; 5.4.3; 5.4.4
16.3 Loss of mechanical strength of machinery and lifting accessories	5.1; 5.2.1.7; 5.2.1.8; 5.2.2.2; 5.2.2.3; 5.2.3.2; 5.2.3.3; 5.2.5.2; 5.2.5.3; 5.3.1.4; 5.4.2; 5.4.3; 5.4.4; 5.4.5; 5.4.6
16.4 Hazards caused by uncontrolled movement	5.2.2.5; 5.2.4; 5.4.1; 5.4.3.4; 5.4.3.5; 5.4.4; 5.12
17 Inadequate view of trajectories of the moving parts	5.13
18 Hazards caused by lightning	7.1.2
19 Hazards due to loading/overloading	5.7
HAZARDS INVOLVING THE LIFTING OF PERSONS BY MCWP	
20 Overloading or overcrowding of the carrier	5.1.2, 5.7, 5.11, see Annex C
21 Unexpected movement of the carrier in response to external controls or other movements of the machine	5.13.7
22 Excess speed	5.4.1; 5.5; 5.6.3
23 Persons falling from the carrier	5.3
24 Falling or overturning of the carrier	5.2.2.3; 5.4.1; 5.5; 5.11; 5.12
25 Excess acceleration or braking of the carrier	5.2.2.4; 5.4.5.1.2; 5.4.6
26 Hazards due to imprecise markings	5.2.2.7; 7.2

5 Safety requirements and/or measures

5.1 Structural and stability calculations

5.1.1 General

5.1.1.1 All loads and forces which can occur in any allowed configuration during erection, operation, out-of-service, dismantling and transfer shall be considered. This shall also include inclined or hanging masts.

5.1.1.2 The manufacturer shall be responsible for

- stability calculations, in order to identify the various configurations of the MCWP and the combinations of loads and deflections which together create conditions of instability;
- structural calculations, to evaluate the individual forces and to make allowance for deflections. All combinations of forces shall be considered, including those which produce the most unfavourable stresses in the components.

5.1.2 Loads and forces

The following loads and forces shall be taken into account.

5.1.2.1 Structural loads

The masses of the components of the MCWP when they are not moving are considered to be static structural loads.

The masses of the components of the MCWP when they are moving are considered to be dynamic structural loads.

5.1.2.2 Rated load

5.1.2.2.1 The rated load, m , expressed in kilograms, for design purposes is as given in Equation (1):

$$m = (n \cdot m_p) + m_{e+m} + (2m_e) \quad (1)$$

where

m_p = 80 kg; mass of each person;

m_e = 40 kg; mass of personal equipment (for the first two persons only);

m_{e+m} is the mass, in kilograms, of material and equipment on the work platform (excluding personal equipment);

n is the number of persons on the work platform.

The mass of persons and the mass of equipment and material shall act simultaneously.

The minimum number of persons shall be two (2) for single-mast platforms and four (4) for multiple-mast platforms.

The mass of the personal equipment, m_e , shall be assumed to act on the point coincident with each of the two persons who give the highest stresses.

5.1.2.2.2 The mass of each person is assumed to act as a point load on the MCWP at a horizontal distance 0,1 m from the upper inside edge of the top guardrail. The distance between the point loads shall be 0,5 m (see the example in Figure 3).

5.1.2.2.3 The mass T shall be evenly distributed over the entire area of the main platform, giving a specific load per length t .

The centre of gravity of the mass T shall be assumed to act on a point 0,15 B (where B is the width of the main platform) away from the longitudinal centreline of the main platform, on the side giving the highest stresses. See Figure 4.

Calculations shall allow for the possibility that a reduced load giving an unbalanced load case may result in higher stresses in some parts of the MCWP than a balanced rated load case would give.

For single-mast machines, the bending moment, M , on masts and platforms shall be calculated according to the equation in Figure 5, where $L_{\max}$ is the greater of the distances L_1 and L_2 in Figure 5.

For multiple-mast machines, the bending moment, M , on masts and platforms shall be calculated according to the equations in Figure 6. The factors 1,15 and 1,2 are used in the equations in Figures 5 and 6 in order to cover the situations in use where, instead of a uniformly distributed load, a concentration of the same load is placed elsewhere within that individual length.

Dimensions in metres

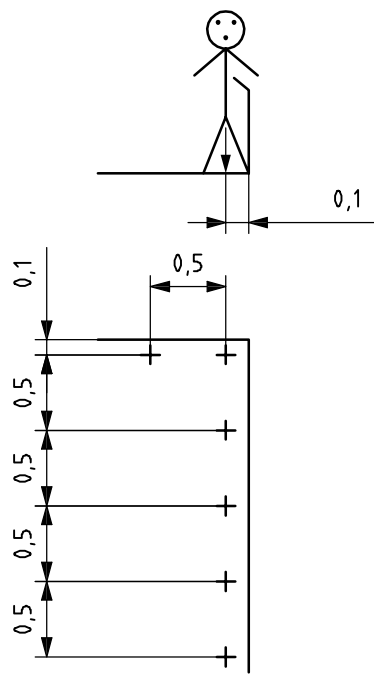
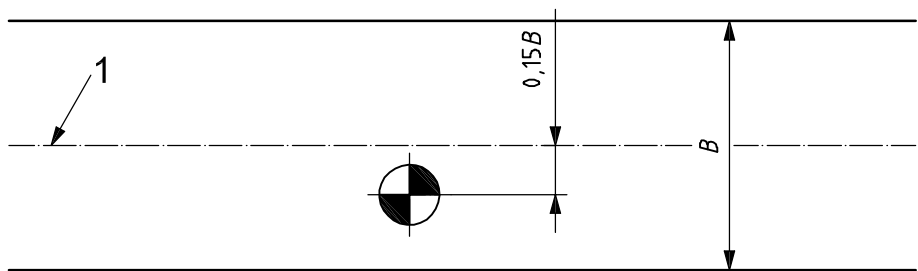


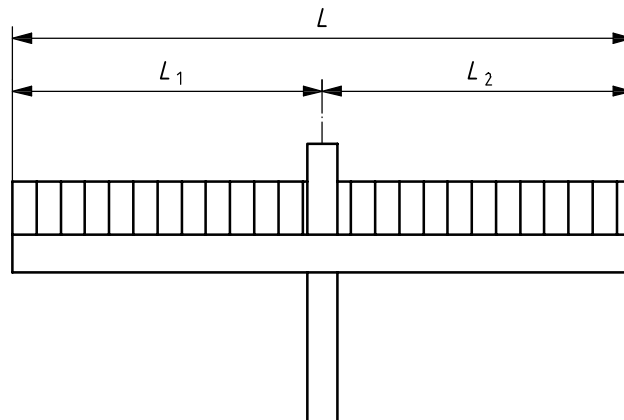
Figure 3 — Example of the distribution of persons on the main platform or platform extensions



Key

- 1 centreline of main platform excluding any extension

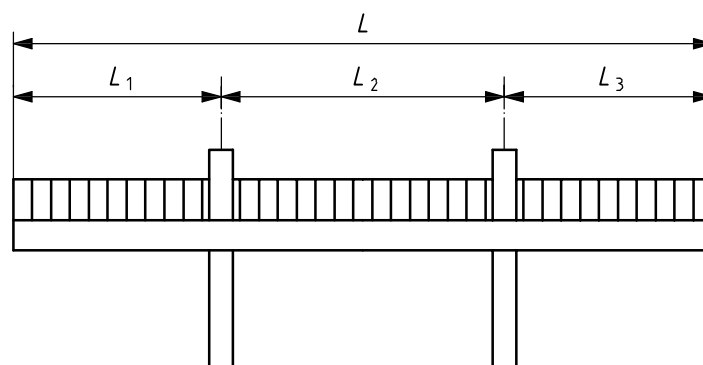
Figure 4 — Eccentric loading normal to the centreline



$$M_{\max} = \frac{t \times L_{\max}^2 \times 1,15}{2}$$

$$\text{Specific load } t = \frac{T}{L}$$

Figure 5 — Loading in the longitudinal direction for single-mast machines



Equations:

$$M_1 = \frac{t \times L_1^2 \times 1,15}{2}$$

$$M_3 = \frac{t \times L_3^2 \times 1,15}{2}$$

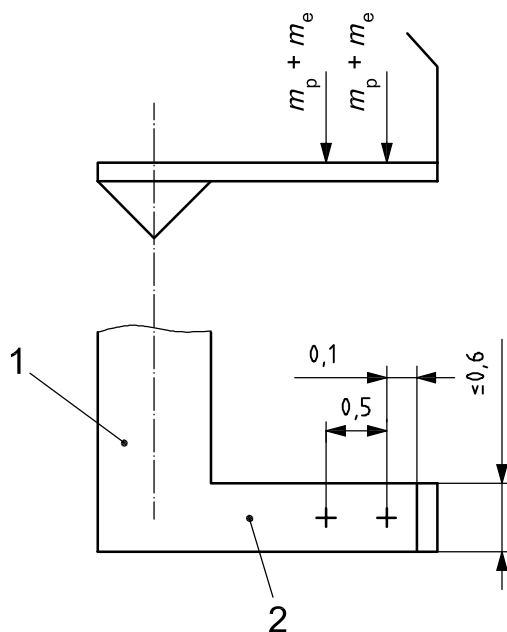
$$M_2 = \frac{t \times L_2^2 \times 1,2}{8}$$

$$\text{Specific load } t = \frac{T}{L}$$

Figure 6 — Loading in the longitudinal direction for multiple-mast machines

5.1.2.2.4 If the area of the main platform, or part of it, is increased by means of extensions, usually to the longitudinal edge of the platform, the mass of the number of persons allowed on the platform, according to 5.1.2.2.1, shall be assumed to act on these longitudinal edges according to 5.1.2.2.2.

5.1.2.2.5 In order to provide long cantilever extensions of restricted width to reach more distant work points, an exception to 5.1.2.2.4 may be made, but shall be clearly explained on a sign easily visible on that particular extension to the main platform. In no such case shall the load on the extension be calculated for less than two persons, m_p , carrying their personal equipment, m_e . In order to restrict the available platform extension area, such extensions shall not be more than 0,6 m wide. See Figure 7.

**Key**

- 1 main platform
- 2 platform extension

Figure 7 — Long cantilever extensions

5.1.2.2.6 Where the manufacturer includes in his design provision for the use of a handling crane, then the mass of the crane and the crane's rated load shall together be treated as part of the rated load of the MCWP. The location of the force resulting from the use of the crane shall be dictated by the manufacturer's chosen mounting positions for the crane supports.

5.1.2.3 Horizontal forces**5.1.2.3.1 Manual forces**

The minimum value for the manual force is assumed to be 200 N for each of the first two persons on the platform and 100 N for each additional person permitted on the work platform.

It is assumed that the force is applied at a height of 1,1 m above the floor of the work platform and acts in a horizontal direction.

5.1.2.3.2 Forces from the use of power tools

Where the manufacturer of the MCWP permits the use of power tools which impose horizontal reaction forces on the work platform which are in excess of those given in 5.1.2.3.1, then the manufacturer shall specify the maximum force permitted. Application of the force shall be assumed at a minimum height of 1,1 m above the floor of the work platform.

Such forces may be caused by the use of, for example:

- water-jetting equipment;
- sand- or grit-blasting equipment;
- mechanically assisted drilling machine;

- hammer-assisted drill;
- electrically driven hammer/breaker.

5.1.2.3.3 Forces from the use of weather-protection screens on the work platform

If the work platform is designed to permit the use of weather protection in the form of a roof over part of, or the whole of, the platform, then the resulting wind forces shall be considered to act on walls which reach the full height, from the work platform floor to the top of the roof. Wind forces shall be calculated according to 5.1.2.5 and 5.1.2.8. For platform regions protected by such weather screens, the wind forces on persons, equipment and material coming under the protection of these weather screens may be neglected.

The mass of the weather-protection screens shall be treated as part of the rated load.

5.1.2.4 Dynamic forces

Dynamic forces shall be taken into account by multiplying all moving masses by a dynamic factor of 1,15.

The term “moving” includes raising and lowering of the work platform and also transfer of the MCWP in its transfer condition.

5.1.2.5 In-service wind loads

5.1.2.5.1 All MCWP used out-of-doors or otherwise exposed to wind whilst in service shall be regarded as being affected by a minimum wind pressure in accordance with Table 2.

Table 2 — Minimum design in-service wind data

Installation	Wind velocity m/s	Wind pressure N/m ²
Free-standing or MCWP during erection and dismantling	12,7	100
Tied MCWP	15,5	150

5.1.2.5.2 Wind forces are assumed to act horizontally at the centre of the windward area of the exposed structural parts of the MCWP.

5.1.2.5.3 The wind force coefficients applied to areas exposed to the wind shall be in accordance with ISO 4302. The wind force coefficient for persons exposed to the wind is 1,0.

5.1.2.5.4 The full area of one person is 0,7 m² (0,4 m average width × 1,75 m height) with the centre of area 1,0 m above the work platform floor.

5.1.2.5.5 The exposed area of one person standing on a work platform behind an imperforate section of fencing 1,1 m high is 0,35 m², with the centre of area 1,45 m above the work platform floor.

5.1.2.5.6 The number of persons directly exposed to the wind is calculated as

- a) the length of the side of the work platform exposed to the wind, rounded to the nearest 0,5 m and divided by 0,5 m, or
- b) the number of persons allowed on the work platform if less than the number calculated in a).

5.1.2.5.7 If the number of persons permitted on the work platform is greater than calculated in 5.1.2.5.6 a), a reducing coefficient of 0,6 may be applied to the extra number of persons.

5.1.2.5.8 The wind force on exposed equipment and material on the work platform is calculated as 3 % of the mass, T , acting horizontally at a height of 1,0 m above the work platform floor.

5.1.2.6 Loads and forces occurring during transfer conditions

Inertia forces plus any load permitted by the manufacturer on the work platform shall be taken into account when the MCWP is subject to transfer conditions.

5.1.2.7 Erection and dismantling loads

The load for which the MCWP has been designed during erection and dismantling shall be recorded. Erection load may be higher than rated load.

If a handling crane, as described in 5.1.2.2.6, is used during erection and dismantling of the MCWP, then the crane's mass and the rated load shall together be treated as part of the erection load.

5.1.2.8 Out-of-service wind loads

The wind pressure used for the calculations for out-of-service condition, with the work platform in a safe position, shall be in accordance with Table 3.

The limiting wind pressure shall be considered in the most unfavourable direction.

Table 3 — Design out-of-service wind pressures

Height of member above ground level m	Wind velocity m/s	Wind pressure N/m ²
0 to 20	35,8	800
over 20 to 100	42	1 100
over 100	45,9	1 300
The values given for wind velocity and wind pressure are minimum values. Information set out in specific national standards shall be used, particularly in special locations.		

5.1.2.9 Buffer forces

Buffer forces shall be calculated taking into account the characteristics of the buffer according to 5.4.6. Where buffers are not used, deceleration or impact forces shall be taken into account.

5.1.2.10 Action of the safety means according to 5.5

To determine the forces produced by an operation of these means, the sum total of all travelling masses shall be multiplied by a factor of 2. A lower factor, but not less than 1,2, may be used if it can be verified by test under all conditions of loading up to 1,5 times the rated load.

5.1.2.11 Inaccuracies in setting-up

For the purposes of calculation, an allowance of an additional 0,5° shall be made to allow for user inaccuracy when erecting the mast.

5.1.3 Load combinations and safety factors

The load combinations to be taken into consideration shall be as follows:

- load combination A1: MCWP in service without wind, static;
- load combination A2: MCWP in service without wind, dynamic;
- load combination B1: MCWP in service with wind, static;
- load combination B2: MCWP in service with wind, dynamic;
- load combination B3: MCWP during erection or dismantling;
- load combination B4: MCWP during transfer condition;
- load combination C1: MCWP striking the buffer whilst in service;
- load combination C2: MCWP during action of the safety means whilst in service;
- load combination C3: MCWP out of service.

The above load-combination references (A1, A2, B1, B2, etc.) are used in Annex A as load case A, load case B and load case C as appropriate.

In each load combination, the loads and forces acting on the MCWP shall be in accordance with Table 4. Safety factors for structural steels and aluminium alloys are given in Table 5 and Table 6 respectively.

Table 4 — Load combinations that shall be taken into consideration

Loads	Ref. subclause	Load combination								
		A1	A2	B1	B2	B3	B4	C1	C2	C3
Structural loads	5.1.2.1	X	X	X	X	X	X	X	X	X
Rated load	5.1.2.2	X	X	X	X			X	X	
Horizontal forces	5.1.2.3	X		X						
Dynamic forces	5.1.2.4		X		X	X	X			
In-service wind loads	5.1.2.5			X	X	X	X			
Loads and forces during transfer	5.1.2.6					X	X			
Erection and dismantling loads	5.1.2.7					X				
Out-of-service wind loads	5.1.2.8									X
Buffer forces	5.1.2.9							X		
Action of safety means	5.1.2.10								X	
Inaccuracies in set-up	5.1.2.11	X	X	X	X	X	X			

Table 5 — Safety factors for structural steels

Load case	Safety factor
A1, A2	1,5
B1, B2, B3, B4	1,33
C1, C2, C3	1,25