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ISO/FDIS 16368

Mobile elevating work platforms — Design, calculations, safety requirements and test methods

*Plates-formes élévatrices mobiles de personnel — Conception,
calculs, exigences de sécurité et méthodes d'essai*

ISO/TC 214

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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

This third edition cancels and replaces the second edition (ISO 16368:2010), which has been technically revised.

The main changes are as follows:

- all requirements from ISO 16653-1 have been integrated into this document;
- in the Scope, additional details have been added included intended use and objectives;
- the normative references have been updated;
- in [Clause 3](#), seven new definitions have been added to support their use in the text;
- [Clause 4](#) has been updated to include a new figure for the rated load of tools and materials; [Table 1](#) and [Figure 3](#) have been revised to show load sensing and enhanced stability examples separately and to include more working configurations; verification methods have been removed from each clause and placed in new [Table 7](#) in [Clause 5](#); access system requirements have been revised to include [Table 4](#) and [Table 5](#);
- in [Clause 6](#), the contents of [Annex F](#) have been merged into [6.2.1](#) and the previous [Annex F](#) has been eliminated;
- [Annex B](#) has been added, and preceding Annexes have been renumbered accordingly.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document is a type-C standard as stated in ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organisations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with disabilities);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in the case of machinery intended for use by consumers)

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

The objective of this document is to establish rules for safeguarding persons and objects against the risk of an accident associated with the operation of mobile elevating work platforms (MEWPs). MEWPs are assemblies of one or more sub-assemblies produced by one or more manufacturers. A MEWP is the product of activities that include design, production, and testing, as well as the provision of information on the MEWP itself.

This document does not repeat all the general technical rules applicable to every electrical, mechanical, or structural component. Its safety requirements have been developed on the basis that MEWPs are periodically maintained according to given instructions, working conditions, frequency of use and national or other regulations. It is assumed that MEWPs are checked for function before start of work, whether used daily or seldom used, and are not put into operation unless all the required control and safety devices are available and in working order. Where, for clarity, an example of a safety measure is given in the text, it is not intended as the only possible solution. Any other solution leading to the same risk reduction is permissible if an equivalent level of safety is achieved.

[Annex A](#) explains the choice of Beaufort Scale 6 as the maximum wind speed.

[Annex B](#) specifies additional requirements for wireless controls and control systems.

[Annex C](#) provides, in addition to those found in the body of this document, appropriate extracts from DIN 15020 (all parts) to avoid the unexplained inconsistencies in coefficients of utilization for wire ropes found in other standards for lifting devices.

[Annex D](#) provides a worked example of the provisions given in [Annex C](#).

[Annex E](#) gives kerb test calculations.

[Annex F](#) presents the list of significant hazards dealt with by this document.

Mobile elevating work platforms — Design, calculations, safety requirements and test methods

1 Scope

This document specifies safety requirements and protective/risk reduction measures, and the means for their verification, for all types and sizes of mobile elevating work platforms (MEWPs) intended for moving a person(s) along with their necessary tools and materials at an elevated work location.

This document also applies to MEWPs designed for applications requiring special access to specific work areas. These MEWPs can be either self-propelled or manually propelled and are used to elevate personnel to a level at which they can place, install, or retrieve objects or material on a routine basis. To facilitate operator access to the work area, the retraction of a portion of the MEWP's work platform guardrail system(s) can be necessary.

This document is intended to serve as a guide for manufacturers and remanufacturers of MEWPs to achieve the following objectives:

- elimination or reduction of accidents and personal injuries;
- establishment of criteria for design, manufacture, remanufacture, rebuild/recondition, testing and performance;
- establishment and understanding by manufacturers and remanufacturers of their responsibilities.

The design and manufacturing requirements of this document apply to all MEWPs manufactured or remanufactured on or after the effective date, but it is not applicable to rebuilt or reconditioned MEWPs.

It identifies the hazards arising from the use of MEWPs and describes methods for the elimination or reduction of these hazards.

This document is not applicable to

- a) permanently installed personnel-lifting appliances serving defined levels,
- b) firefighting and fire rescue appliances (see for example, EN 1777),
- c) unguided work cages suspended from lifting appliances (see for example, EN 1808),
- d) elevating operator position on rail-dependent storage and retrieval equipment (see for example, EN 528),
- e) tail lifts (see for example, EN 1756-1:2001+A1:2008, EN 1756-2:2004+A1:2009),
- f) mast-climbing work platforms (see ISO 16369),
- g) fairground equipment,
- h) lifting tables with a lifting height of less than 2 m (see for example, EN 1570-1:2011+A1:2014),
- i) builder's hoists for persons and materials,
- j) aircraft ground-support equipment (see for example, EN-1915-1:2013, EN-1915-2:2001+A1:2009),
- k) digger derricks,
- l) elevating operator positions on industrial trucks (see for example, ISO 3691-3),

- m) elevating operator positions on cranes,
- n) certain requirements for insulating aerial devices on a chassis for use in live work on electrical installations (see Note 1),
- o) multi-purpose elevating platform powered industrial trucks (MPEPs) controlled by a single stand-up riding operator and intended to be used for manually picking and transporting small items at height,
- p) powered industrial trucks used to pick and place stock or inventory.

NOTE 1 For requirements for use near live electrical installations, see ISO 16653-2. For requirements for use on live electrical installations, see IEC 61057.

It does not cover hazards arising from:

- use in potentially explosive atmospheres,
- use of compressed gases for load-bearing components,
- derailment and runaway of rail-mounted MEWPs,
- work on live electrical systems (see Note 2 and Note 3).

NOTE 2 Hazards arising from work on live electrical systems are addressed in IEC 61057.

NOTE 3 For MEWPs that employ aerial devices used for live working, this document is to be used in conjunction with IEC 61057, taking into consideration the potential exceptions from this document that are specified in IEC 61057.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 3864 (all parts), *Graphical symbols — Safety colours and safety signs*

ISO 4305, *Mobile cranes — Determination of stability*

ISO 7000, *Graphical symbols for use on equipment — Registered symbols*

ISO 12100, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

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

ISO 13850, *Safety of machinery — Emergency stop function — Principles for design*

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

ISO 18893:—¹⁾, *Mobile elevating work platforms — Safety principles, inspection, maintenance, and operation*

ISO 20332, *Cranes — Proof of competence of steel structures*

ISO 21455, *Mobile elevating work platforms — Operator's controls — Actuation, displacement, location and method of operation*

IEC 60068-2-64, *Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance*

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

IEC 60204-32:2023, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines*

1) Under preparation. Stage at the time of publication: ISO/DIS 18893:2023.

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

IEC 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

access position

position(s) to provide access to and from the *work platform* (3.58)

Note 1 to entry: The access position, *lowered travel position* (3.21), *stowed position* (3.51) and *transport position* (3.52) can be identical.

3.2

aerial device

device, extensible, articulating or both, which is primarily designed and used to position personnel

Note 1 to entry: This does not include the *chassis* (3.5). When an aerial device is mounted on a mobile *chassis* (3.5) it becomes a component of a MEWP. The device can also be used to handle material, if designed and equipped for that purpose.

3.3

anchorage

designated point of attachment utilized with a personal fall protection system

3.4

chain drive system

system that comprises one or more chains running on chain sprockets or over chain pulleys, as well as any associated chain sprockets, chain pulleys and compensating pulleys

3.5

chassis

base of a MEWP

Note 1 to entry: See [Figure 1](#).

Note 2 to entry: The chassis can be pulled, pushed, self-propelled, etc.

3.6

ductile materials

materials that have a minimum elongation at fracture of 10 % in a gauge length of 51 mm of a standard tensile test specimen

3.7

elevated travel position

configuration(s) of the MEWP for travel outside of the *lowered travel position* (3.21)

3.8

extending structure

structure which is connected to the *chassis* (3.5) and supports the *work platform* (3.58) and which allows movement of the *work platform* (3.58) to its required position

Note 1 to entry: See [Figure 1](#).

3.9

fall arrest system

personal fall protection system designed to arrest the fall of an *operator* (3.36) or *occupant(s)* (3.35)

3.10

fall restraint system

personal fall protection system that restrains or prevents an *operator* (3.36) or *occupant(s)* (3.35) from reaching a fall hazard

3.11

finite element analysis

FEA

computerized method of idealizing a real model for the purposes of performing structural analysis

3.12

folding guardrails

guardrails capable of being reduced in height

Note 1 to entry: For facilitating MEWP movement under obstructions and for ease of transport.

3.13

handhold

device for single hand placement that aids body support and balance

3.14

handrail

device for hand placement that aids body support and balance and permits hand movement on the device

Note 1 to entry: A handrail can be part of a guardrail.

3.15

indoor use

operation in areas shielded from wind so that there is no wind force acting on the MEWP being operated

3.16

instability

condition of a MEWP in which the sum of the moments which tend to overturn the MEWP exceeds the sum of the moments which tend to resist overturning

3.17

installer

entity that installs an *aerial device* (3.2) on a *chassis* (3.5)

Note 1 to entry: The installer can also be the *responsible entity* (3.43).

3.18

load cycle

cycle starting from an *access position* (3.1) and completed by the carrying out of work and return to the same *access position* (3.1)

3.19

load-sensing system

system of monitoring the vertical load and vertical forces on the *work platform* (3.58)

3.20

lowering, noun

operations, other than travelling, for moving the *work platform* (3.58) to a lower level

Note 1 to entry: See [Figure 1](#).

3.21

lowered travel position

configuration(s) of the MEWP, as defined by the *responsible entity* (3.43), for travel up to maximum travel speed

Note 1 to entry: The lowered travel position, *access position* (3.1), *stowed position* (3.51), and *transport position* (3.52) can be identical.

3.22

mobile elevating work platform

MEWP

machine/device intended for moving a person(s), along with their necessary tools and material to an elevated work location, consisting of at least a *work platform* (3.58) with controls, an *extending structure* (3.8) and a *chassis* (3.5)

3.23

group A MEWP

MEWPs on which the vertical projection of the centre of the *work platform* (3.58) area, in all work platform configurations at the maximum chassis inclination specified by the manufacturer, is always inside the tipping lines

3.24

group B MEWP

MEWPs not in group A

3.25

type 1 MEWP

MEWP for which travelling is only allowed when in the *stowed position* (3.51)

3.26

type 2 MEWP

MEWP for which travelling with the *work platform* (3.58) in the *elevated travel position* (3.7) is controlled from a point on the *chassis* (3.5)

Note 1 to entry: Type 2 MEWPs and type 3 MEWPs can be combined.

3.27

type 3 MEWP

MEWP for which travelling with the *work platform* (3.58) in the *elevated travel position* (3.7) is controlled from a point on the *work platform* (3.58)

Note 1 to entry: Type 2 MEWPs and type 3 MEWPs can be combined.

3.28

pedestrian-controlled MEWP

MEWP whose controls for powered travel can be operated by a person walking close to the MEWP

3.29

rail-mounted MEWP

MEWP whose travel is guided by rails

3.30

self-propelled MEWP

MEWP whose travel is powered by an internal power source

3.31

totally manually operated MEWP

MEWP whose movement is powered only by manual effort

3.32

vehicle-mounted MEWP

MEWP whose *aerial device* (3.2) is designed for and installed on a vehicle *chassis* (3.5)

3.33

moment-sensing system

system monitoring the moment acting about the tipping line tending to overturn the MEWP

3.34

non-ductile materials

brittle materials

materials that are not classified as *ductile materials* (3.6)

3.35

occupant(s)

person(s) in the *work platform* (3.58) other than *operator* (3.36)

3.36

operator

person who controls the operation of a MEWP

3.37

oscillating axle

supporting structure which allows mainly vertical movement of the end wheel assemblies independently or in relation to each other

3.38

outdoor use

use of a MEWP in an environment that can be exposed to wind

3.39

raising, noun

operation, other than travelling, that moves the *work platform* (3.58) to a higher level

Note 1 to entry: See [Figure 1](#).

3.40

rated load

load for which the MEWP has been designed in normal operation, comprising persons, tools and materials, acting vertically on the *work platform* (3.58) [ISO/FDIS 16368](#)

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Note 1 to entry: A MEWP can have more than one rated load.

3.41

rebuild/recondition

overhaul or repair of a MEWP, accomplishing work beyond the scope of maintenance, utilizing replacement parts and components, in order to restore the MEWP to the original standard(s)

3.42

remanufacture

modification of a MEWP, either by the original manufacturer or *responsible entity* (3.43), so that the MEWP will comply with one or more standards in effect on the date the remanufacture is completed

3.43

responsible entity

person or entity with responsibility for the design, specification, procurement, fabrication, manufacture, assembly, provision of information and testing of a MEWP sub-assembly or ready-for-use MEWP

Note 1 to entry: Depending on national regulations or local practice, this term can refer to one or more of the following entities: manufacturer, installer, custodian, dealer, or entity placing the product on the market.

3.44

retractable guardrail

guardrail where a portion is capable of being locked in a retracted position without reducing overall height

Note 1 to entry: For accessing a work area.