
**Mobile elevating work platforms —
Design, calculations, safety requirements
and test methods relative to special
features —**

Part 2:

**MEWPs with non-conductive (insulating)
components**

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

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Partie 2: PEMP avec composants non conducteurs (isolants)



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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 16653-2 was prepared by Technical Committee ISO/TC 214, *Elevating work platforms*.

ISO 16653 consists of the following parts, under the general title *Mobile elevating work platforms — Design, calculations, safety requirements and test methods relative to special features*:

— *Part 1: MEWPs with retractable guardrail systems*

— *Part 2: MEWPs with non-conductive (insulating) components*

MEWPs for orchard operations are to form the subject of a future part 3.

Introduction

The object of ISO 16653 is to define rules for safeguarding persons and objects against the risk of accident associated with the operation of special-application mobile elevating work platforms (MEWPs).

The requirements of ISO 16653 are intended to supplement or modify those of ISO 16368. Unless specified otherwise within this part of ISO 16653, all the relevant provisions of ISO 16368 are applicable in addition to the provisions of this part of ISO 16653.

ISO 16653 does not repeat all the general technical rules applicable to every electrical, mechanical or structural component.

The safety requirements of this part of ISO 16653 have been drawn up on the basis that MEWPs are periodically maintained according to the manufacturer's instructions, working conditions, frequency of use and applicable regulations.

It is assumed that MEWPs will be checked for function daily before start of work and that they will not be put into operation unless all required control and safety devices are available and in working order.

If a MEWP is seldom used, the checks may be made before start of work.

Where, for clarity, an example of a safety measure is given in the text, this is not intended as the only possible solution. Any other solution leading to an equivalent level of safety is permissible.

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Mobile elevating work platforms — Design, calculations, safety requirements and test methods relative to special features —

Part 2: MEWPs with non-conductive (insulating) components

1 Scope

This part of ISO 16653 specifies the design, calculations, safety requirements and test methods for mobile elevating work platforms (MEWPs) with non-conductive (insulating) components. It is intended to be used in conjunction with ISO 16368.

It is applicable to all types and sizes of MEWPs with non-conductive (insulating) components, including dielectric components designed and tested to meet the specific electrical properties consistent with the manufacturer's identification plate. This equipment is intended to move persons, tools and equipment to working positions where they can carry out work from a work platform located above a non-conductive boom section.

This part of ISO 16653 covers structural design calculations and the application of stability criteria, construction, safety examinations and tests done before MEWPs with non-conductive (insulating) components are first put into service. It identifies the hazards arising from the use of MEWPs with non-conductive (insulating) components and describes methods for the elimination or reduction of these hazards.

The MEWPs covered are not intended to have any of their components make contact with live parts of electrical installations. The electrical properties of a MEWP's non-conducting (insulating) components can provide electrical protection in case of inadvertent contact above the non-conductive boom component at the platform end. If a MEWP is equipped with a chassis insulating system, it can provide electrical protection for ground personnel in case of inadvertent contact above that system.

This part of ISO 16653 is not applicable to MEWPs designed for live working (see IEC 61057).

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 16368:—¹⁾, *Mobile elevating work platforms — Design, calculations, safety requirements and test methods*

ISO 18893:2004, *Mobile elevating work platforms — Safety principles, inspection, maintenance and operation*

IEC 61057, *Live working — Insulating aerial devices for mounting on a chassis*²⁾

1) To be published. (Revision of ISO 16368:2003)

2) To be published. (Revision of IEC 61057:1991)

3 Terms and definitions

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

3.1 chassis insulating system
 system of non-conductive (insulating) components installed between the chassis and the structure supporting the upper non-conductive (insulating) boom

NOTE Such a system, when properly maintained, can provide insulation of the chassis should the portion of the MEWP between the upper non-conductive (insulating) boom and this system inadvertently contact an energized conductor or other apparatus.

3.2 electrical insulation level
 level of phase-to-earth (ground) electrical insulation offered by the non-conductive (insulating) components of the upper boom and expressed by the maximum nominal voltage of an electrical installation (line or equipment) in case of inadvertent contact with this installation above the non-conductive (insulating) components at the platform end of the MEWP

NOTE 1 The electrical insulation level is established by the MEWP-responsible entity.
 NOTE 2 The electrical insulation level is limited to voltages experienced in electrical distribution systems (46 kV and below).

3.3 insulating liner
 insert made of non-conductive (insulating) material and designed to fit inside the platform

3.4 non-destructive testing
 examination by various means of devices or their components without alteration of the original components, so that they may function as before

NOTE These include acoustic emissions (AE), magnetic particle (MT), liquid penetrant (PT), ultrasonic (UT), radiography (RT), dielectric (DT), and visual (VT).

4 List of hazards

The hazards identified by the risk assessment procedure are presented in Table 1.

Table 1 — List of hazards

Hazards		Relevant subclauses of this part of ISO 16653
1	Electrical hazards , caused for example by:	—
1.1	Electrical contact (direct or indirect)	5.4.2, 5.4.3, 5.5
2	Hazards caused by (temporary) missing and/or incorrectly positioned safety-related measures/means , for example:	—
2.1	Safety signs and signals	7.3.2
2.2	Essential equipment and accessories for safe adjusting and/or maintaining	8.1
3	Markings	7.3

5 Safety requirements and/or protective measures

5.1 Structural calculations

The following sections are to be used for the structural calculations according to ISO 16368:—, 5.2.5.

5.1.1 Bursting safety factors

In addition to the requirements of ISO 16368, all components of the hydraulic system other than pipes connections, hoses and fittings, and hydraulic cylinders, as specified in ISO 16368:—, 5.9.2, 5.9.3 and 5.10, shall be rated according to performance criteria, such as rated flow and pressure, life cycles, pressure drop, revolutions per minute, torque and speed. They shall have a minimum bursting strength of at least two times the operating pressure for which the system is designed. Such components generally include pumps, motors, directional controls and similar functional components.

5.2 Hydraulic liquid

Hydraulic liquid (usually oil or similar fluid) shall meet the requirements of the responsible entity and the insulating requirements of the MEWP.

5.3 Non-conductive hydraulic and pneumatic hoses

Non-conductive hydraulic hoses shall meet the requirements of IEC 61057. Non-conductive pneumatic hoses shall have electrical characteristics similar to non-conductive hydraulic hoses.

5.4 Work platforms

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5.4.1 Work platforms constructed from non-conductive materials designed for use without liners

See ISO 16368:—, 5.6.15. <https://standards.iteh.ai/catalog/standards/sist/6f52eff1-0693-4cba-9931-c9ee827c8336/iso-16653-2-2009>

5.4.2 Work platforms designed for use with non-conductive (insulating) liners

Work platforms shall be constructed from non-conductive materials. The work platform shall be identified as non-insulating. Non-conductive (insulating) liners for these work platforms shall be constructed from non-conductive materials and tested in accordance with IEC 61057. The liner shall be supported by the inside bottom surface of the work platform. These non-insulating work platforms shall not have drain holes or access openings. The work platform shall be constructed of materials that will not sustain a flame after an ignition source has been removed.

5.4.3 Non-conductive (insulating) work platforms

Non-conductive (insulating) platforms shall be constructed from non-conductive materials and shall have no drain holes or access openings. Non-conductive (insulating) work platforms shall be tested in accordance with the dielectric tests for insulating liners as defined in IEC 61057. The work platform shall be constructed of materials that will not sustain a flame after an ignition source has been removed.

5.5 Electrical requirements

5.5.1 Non-conductive (insulating) components

All components crossing non-conductive (insulating) portions of the applicable MEWP shall have appropriate electrical insulating properties in order that it complies with the test requirements of this part of ISO 16653. All non-conductive (insulating) systems shall maintain the electrical insulating values in all working boom positions, as defined by the responsible entity.

5.5.2 Vacuum prevention systems

All MEWPs with non-conductive (insulating) components having a nominal platform height greater than 15 m shall have a method for preventing vacuum formation and the resulting reduction in dielectric strength in all hydraulic or pneumatic hoses that cross non-conductive (insulating) sections.

5.5.3 Hydraulic and pneumatic hose

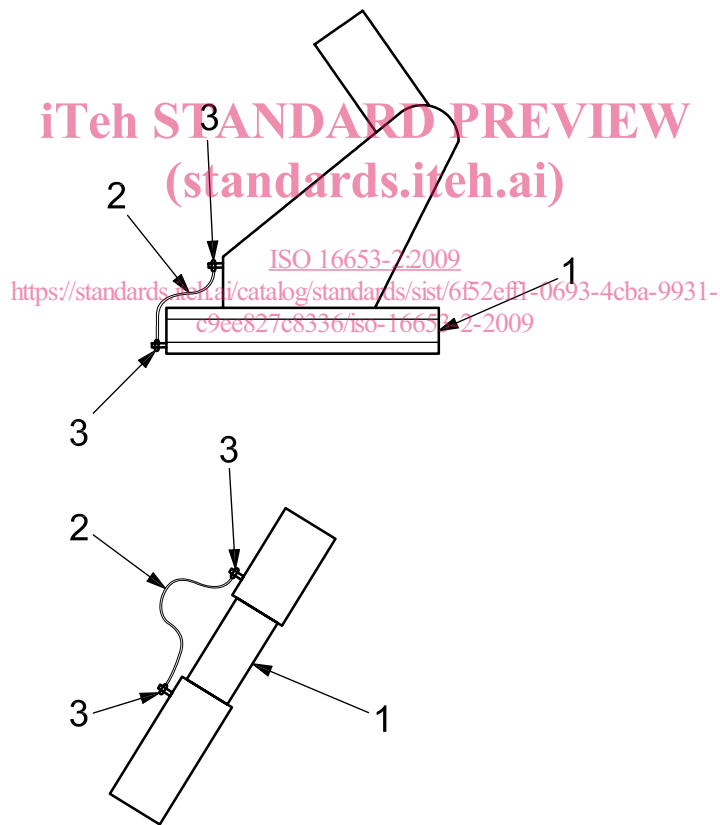
All hydraulic and pneumatic hoses crossing the non-conductive (insulating) portion of the upper boom shall be tested in accordance with IEC 61057.

5.5.4 Lower test electrode system for MEWPs with non-conductive (insulating) components

Some MEWPs with non-conductive (insulating) components may be equipped with a lower test electrode system. If so equipped, this system shall meet the lower test electrode system requirements of IEC 61057.

5.5.5 Chassis insulating system

MEWPs with a chassis insulating system shall have a means provided to bypass the chassis insulating system during dielectric tests. See Figure 1.



Key

- 1 insulating system
- 2 temporary shunt (remove after test)
- 3 stainless steel stud with 25 mm thread exposed

Figure 1 — Suggested shunting arrangement for chassis insulating systems

6 Verification of the safety requirements and/or protective measures

6.1 Type tests

Each MEWP with non-conductive (insulating) components shall be type-tested in accordance with ISO 16368:—, 6.2. This identifies the test to be performed in lieu of ISO 16368:—, 6.1.3 a) and b).

6.2 Dielectric tests³⁾

6.2.1 Test criteria for MEWPs with a non-conductive (insulating) boom

Each MEWP with non-conductive (insulating) upper boom shall undergo one of the tests described in Table 2 to verify the insulating performance of the components of the non-conductive (insulating) boom assembly. This test may be conducted before or after installation on a chassis.

When a MEWP is modified or altered after the dielectric test prior to mounting, the test shall be performed again following the modification or alteration.

NOTE Alteration or modification includes such things as the addition of another platform, a jib, a winch, or other auxiliary devices, and other alterations. The installer is also cautioned that the addition of devices is carried out with the written approval of the responsible entity in order that the requirement for design testing is met.

Table 2 — Dielectric test values for MEWPs with non-conductive (insulating) boom

Test for MEWPs with lower test electrode system	
Required 50 Hz to 60 Hz test voltage (rms kV) for 1 min	Maximum allowable current
Line-to-earth (ground) voltage of nominal line voltage ^a X 2	1 µA per kilovolt of test voltage
Test for MEWPs without lower test electrode system	
Required 50 Hz to 60 Hz test voltage (rms kV) for 3 min	Maximum allowable current
Line-to-earth (ground) voltage of nominal line voltage ^a X 2	10 µA per kilovolt of test voltage

^a Nominal line voltage (rms kV) reflects the responsible entity's rated electrical insulation level and shall be not more than 46 kV.

6.2.2 Test criteria for MEWPs with a chassis insulating system

Each MEWP equipped with a chassis insulating system shall undergo a dielectric test to verify the non-conductivity or insulating quality of the non-conductive (insulating) components of the chassis insulating system. The test shall be carried out in accordance with 6.3.4. The test voltage shall be applied to the metal above the chassis insulating system. The test voltage shall be 50 kV (rms) at a frequency of 50 Hz to 60 Hz and shall be applied for 3 min. The current shall not exceed 3 mA.

3) MEWPs rated or valued by a responsible entity as being capable of live working are not covered by this part of ISO 16653 (see IEC 61057).