INTERNATIONAL STANDARD

ISO 21873-2

Second edition
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Building construction machinery and equipment — Mobile crushers —

Part 2: Safety requirements and verification

Machines et matériels pour la construction des bâtiments — Concasseurs mobiles —
Partie 2: Exigences de sécurité et vérification

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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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*.

This second edition cancels and replaces the first edition (ISO 21873-2:2009), which has been technically revised.

The main changes compared to the previous edition are as follows:

— general — applying to the entire document:
  — "and verification" has been added to the title for consistency;
  — additional clause numbering has been added for better readability and consistency;
  — "this part of ISO 21873" has been changed to "this document";
— in the Introduction, additional information has been added to conform with ISO Guide 78;
— in Clause 2, normative references have been updated as appropriate;
— in Clause 3, a reference to the ISO and IEC terminological databases has been added;
— in Clause 4:
  — 4.2 has been simplified as the former text was already covered in the reference;
  — in 4.3.2, examples have been added;
  — in 4.4, the text related to visibility has been removed as it was ambiguous and not verifiable;
  — in the title of 4.5, the term "Operator's" has been added;
  — a new 4.5.6 relating to remote control has been added;

  - 4.7 on brake systems has been split into 2 parts: one general and one for parking brakes;
  - in 4.9, the term "crusher" has been replaced by "crushing device";
  - in 4.8, 4.9, 4.10, and 4.11, titles have been added for better readability;
  - in 4.9.5, gyratory crushers have been removed and the clause has been rewritten;
  - in 4.14, an alternative method for noise emission measurement has been added;
  - in 4.16, lifting and tie-down clarifications have been added on what requirements are for transport and what requirements are for maintenance;
- in Clause 5, clarifications have been made regarding documentation;
- in Clause 6, the term "machine" has been removed when relating to safety labels;
- in Annex A:
  - references have been updated as appropriate;
  - column for ISO 12100-2 has been removed;
- in Annex C, a new general warning related to rock breakers has been added;
- in the Bibliography, the references have been updated and a reference to ISO 13732-1 for hot surfaces has been added.

A list of all parts in the ISO 21873 series can be found on the ISO website.

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.

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 special needs);

— 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 -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.

This document deals with mobile crushers which are used for crushing rocks or reprocessing construction materials.

Building construction machinery and equipment — Mobile crushers —

Part 2: Safety requirements and verification

1 Scope

This document establishes the safety requirements for mobile crushers, as defined in ISO 21873-1, for crushing rocks or for reprocessing construction materials and capable of re-location between worksites.

It applies to mobile crushers that are either

— self-propelled (mounted on a chassis);

— lorry (truck) mounted;

— or semi-trailer mounted.

It does not apply to

— fixed (stationary) crushers;

— large mining-type movable crushers.

This document deals with significant hazards, hazardous situations and events relevant to mobile crushers when used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer.

This document is not applicable to machines which are manufactured before the date of its publication.

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 2860, *Earth-moving machinery — Minimum access dimensions*

ISO 2867, *Earth-moving machinery — Access systems*

ISO 3457, *Earth-moving machinery — Guards — Definitions and requirements*

ISO 3744, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering methods for an essentially free field over a reflecting plane*

ISO 3795, *Road vehicles, and tractors and machinery for agriculture and forestry — Determination of burning behaviour of interior materials*

ISO 4413, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

ISO 6011, *Earth-moving machinery — Visual display of machine operation*

ISO 6405-1, *Earth-moving machinery — Symbols for operator controls and other displays — Part 1: Common symbols*

ISO 6750, *Earth-moving machinery — Operator's manual — Content and format*

ISO 9244, *Earth-moving machinery — Machine safety labels — General principles*

ISO 9247, *Earth-moving machinery — Electrical wires and cables — Principles of identification and marking*

ISO 10264, *Earth-moving machinery — Key-locked starting systems*

ISO 10265, *Earth-moving machinery — Crawler machines — Performance requirements and test procedures for braking systems*

ISO 10533, *Earth-moving machinery — Lift-arm support devices*

ISO 10968:2004, *Earth-moving machinery — Operator's controls*

ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction*

ISO 12508, *Earth-moving machinery — Operator station and maintenance areas — Bluntness of edges*

ISO 13766-1, *Earth-moving and building construction machinery — Electromagnetic compatibility (EMC) of machines with internal electrical power supply — Part 1: General EMC requirements under typical electromagnetic environmental conditions*

ISO 13766-2, *Earth-moving and building construction machinery — Electromagnetic compatibility (EMC) of machines with internal electrical power supply — Part 2: Additional EMC requirements for functional safety*

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 13857, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14120, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 15817, *Earth-moving machinery — Safety requirements for remote operator control systems*

ISO 15818, *Earth-moving machinery — Lifting and tying-down attachment points — Performance requirements*

ISO 15998, *Earth-moving machinery — Machine-control systems (MCS) using electronic components — Performance criteria and tests for functional safety*

ISO 16528-1, *Boilers and pressure vessels — Part 1: Performance requirements*

ISO 16528-2, *Boilers and pressure vessels — Part 2: Procedures for fulfilling the requirements of ISO 16528-1*

ISO 17063, *Earth-moving machinery — Braking systems of pedestrian-controlled machines — Performance requirements and test procedures*

ISO 21507, *Earth-moving machinery — Performance requirements for non-metallic fuel tanks*

ISO 21873-1:2015, *Building construction machinery and equipment — Mobile crushers — Part 1: Terminology and commercial specifications*

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

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100 and ISO 21873-1 apply.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

4 Safety requirements and/or protective/risk reduction measures

4.1 General

4.1.1 Machinery shall comply with the safety requirements and/or protective/risk reduction measures of this clause.

4.1.2 In addition, the machine shall be designed according to the principles of ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.

4.2 Access

Access systems shall be in accordance with ISO 2867.

4.3 Operator's station

4.3.1 General

If the travel and working controls are in different locations, the requirements of this document shall be met at each location.

4.3.2 Moving parts

Measures shall be taken to avoid accidental contact from the operating position with moving parts, for example, wheels, tracks or working equipment and/or attachments, in accordance with the relevant sub-clauses of Clause 4.

4.3.3 Engine exhaust

The engine exhaust system shall release the exhaust gas away from the operator.

4.3.4 Sharp edges

The operator's working space within the operator's station, for example, instrument panels and access to the operator's station, shall not present any sharp exposed edges or acute angles/corners. The radius of corners and the bluntness of edges shall comply with ISO 12508, in order to avoid sharp edges.

4.3.5 Pipes and hoses

Pipes and hoses shall be guarded in accordance with 4.19.2.

4.3.6 Construction

For self-propelled mobile crushers equipped with an operator station, all handrails shall be constructed in accordance with ISO 2867. Especially for travel, the operator station shall be large enough to prevent injury to the operator during travel over irregular surfaces. It shall include provisions for stopping the

operator from falling on, or being ejected from, the machine and for allowing the operator to maintain control when travelling over irregular surfaces. The operator station shall be provided with a ROPS (roll over protective structure) if there is a risk of the machine rolling over, or FOPS (falling object protective structure) if there is a risk from falling objects.

4.4 Lighting

Machines shall be equipped with lighting devices for travel only. If required, illumination for operation should be provided by surrounding light sources. This shall be noted in the operator's manual.

4.5 Operator's controls and indicators

4.5.1 General

4.5.1.1 Self-propelled mobile crushers equipped with an operator station for travel shall have the controls (for example, hand levers, joysticks, pedals, switches) and indicators located, designed and manufactured in accordance with ISO 10968, and such that

a) they are of easy access, in accordance with ISO 6682 and ISO 10968,

b) the neutral positions of the controls are in accordance with ISO 10968:2004, 5.1.3,

c) they are clearly identified in accordance with ISO 6405-1 and ISO 6405-2 in the operator's station and explained in the operation manual (see 6.2),

d) the movement of their controls for activating functions and indicators shall correspond to the intended effect or common practice whenever possible,

e) the normal engine stop device is within the zone of reach as defined by ISO 6682, when a control such as a keyboard or joystick control (see the requirements for joysticks given in ISO 10968) is designed and constructed to carry out several of the machine's functions, the activated function(s) are clearly identified,

f) for the safety-related functions of control system(s), the principles outlined in ISO 13849-1 shall be followed.

4.5.1.2 A mobile crusher shall be equipped with components to allow isolation of the main power source (lockout/tag-out of the machine). This can be accomplished by providing a locking battery disconnect and/or e-stop switch. These lockout/tag-out provisions shall be noted in the operator's manual.

4.5.1.3 The controls shall include a pre-start warning alerting that a function is about to start in case the operator cannot verify that personnel are clear of all hazard zones from any control position. An acoustic and/or visual warning signal shall be activated prior to the start of a function for a duration sufficient to allow personnel to leave the hazard zone.

4.5.2 Emergency stop

4.5.2.1 Self-propelled mobile crushers equipped with an operator station for travel shall have an emergency stop conforming to ISO 13850 located in close proximity to the travel controls.

4.5.2.2 All mobile crushers shall have at least one emergency stop mounted on each side of the machine that is accessible while standing on the ground. Emergency stops shall not be located such that personnel have to enter a hazard zone in order for them to be activated. Emergency stops shall have a provision for isolating the main energy source (lockout provisions), if no other lockout provisions are provided on the machine.

