International Standard

ISO 18758

Mining and earth-moving machinery — Rock drill rigs and rock reinforcement rigs — Safety requirements

Engins d'exploitation minière et de terrassement — Machines de forage pour roches et de renfort de roches — Exigences de sécurité

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Foreword

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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).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had not received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

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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.

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This document was prepared by Technical Committee ISO/TC 82, *Mining*, in cooperation with Technical Committee ISO/TC 127, *Earth-moving machinery*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 196, *Mining machinery and equipment – Safety*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

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This first edition of ISO 18758 cancels and replaces the first edition of ISO 18758-2:2018 which has been technically revised.

The main changes are as follows:

a) the short-form term rig has generally been replaced by machine;

b) the scope, vocabulary, structure and internal references have been revised, and repeated requirements have been deleted;

c) requirements for manual handling, lifting, access systems, transport locking and carrier machines have been revised;

d) electrical, high-voltage, electromagnetic-compatibility and lightning-protection requirements have been added or revised;

e) requirements for operator stations have been revised, including operator enclosures, seats, seat belts, field of view, protective structures, glazing, vibration and operator-enclosure air quality;

f) requirements for boom-mounted working platforms and temporary roof-support systems have been revised;

g) performance-level and validation requirements have been added for identified safety-related control functions;

h) requirements for emergency stops, cableless controls, diagnostics, laser equipment and control-system security have been added or revised;

i) requirements for fluid-power systems, structural strength and rigid-body stability have been revised;

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j) carrier-brake requirements and test methods have been revised to align more closely with ISO 3450;

k) winch, rope and chain requirements have been revised;

l) requirements for protection against moving and rotating drilling parts have been revised, including requirements for guards, person-detection systems, restricted drill-string handling mode, drill-movement disabling switches and two-hand controls;

m) noise and vibration requirements and their associated test codes have been revised;

n) requirements for propulsion batteries, lithium-ion battery systems and conductive charging have been added;

o) diesel-engine, fuel-system and fire-protection requirements have been revised, including fixed fire-suppression systems for self-propelled underground machines;

p) requirements for explosive atmospheres and drill-dust suppression have been added and strengthened;

q) verification table has been added to Clause 5;

r) Clause 6 has been expanded to include revised requirements for signals, warning devices, safety signs, graphical symbols, marking and instructions for use;

s) the annexes and Bibliography have been restructured and revised.

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.

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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;

— mining companies;

— health and safety bodies (regulators, accident prevention organisations, market surveillance, etc.).

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

— machine operators;

— service providers, e.g. for maintenance;

— third party system and technology providers.

The above-mentioned stakeholder groups have been given the possibility to participate in 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.

The vocabulary of ISO 22932-5 is essential for the understanding of the safety requirements of this document.

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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 rock drill rigs and rock reinforcement rigs that have been designed and built in accordance with the requirements of this type C standard.

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The following assumptions were made in writing this document:

a) the operators of the machines are well trained professionals and aware of potential risks of using the machine in the working environment, including the hazards of reasonably foreseeable misuse (see ISO/IEC Guide 51:2014, 6.1 a), b));

b) the machines are operated and maintained in accordance with the instructions given by the manufacturer, such as instruction handbook (see ISO/IEC Guide 51:2014, 7.4.2.2);

c) that administrative controls are in place for preventing unauthorized entry of persons to the area where machines are working (see ISO/IEC Guide 51:2014, 6.2.2 and note).

For increased readability of this document, rock drill rigs and rock reinforcement rigs are called machines from Clause 4 onwards unless the specific term is needed for emphasis or clarity.

Where for clarity an example of a safety measure is given in the text, this does not need to be considered as the only possible solution. Alternative could exist that achieve an equivalent level of risk reduction.

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Mining and earth-moving machinery — Rock drill rigs and rock reinforcement rigs — Safety requirements

1 Scope

This document specifies the safety requirements for rock drill rigs and rock reinforcement rigs designed for the following underground or surface operations:

a) blast hole drilling;

b) rock reinforcement and consolidation (injection holes, pipe roofing, netting, bolting);

c) drilling for secondary breaking;

d) dimensional stone drilling;

e) mineral prospecting, e.g. utilizing core drilling or reverse circulation drilling;

f) water and methane drainage drilling;

g) raise boring;

when used by a well-trained operator in accordance with the information for use and where sufficient measures have been taken to prevent unauthorized entry of persons to the area where machines are working.

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NOTE Machines can be designed for more than one of the operations above. See ISO 22932-4 and ISO 22932-5 for vocabulary.

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This document is not applicable to the following machines: drill rigs for soil and rock mixture, Kelly drill rigs and casing drivers, cable tool drill rigs, pre-armouring machines, sonic drill rigs, shaft sinking drill rigs, crane attached drill rigs, drill rigs on derricks, scaling machines.

This document deals with the relevant and significant hazards, hazardous situations, or hazardous events, as listed in Annex C, when the machine is used as intended and under the conditions of misuse which are reasonably foreseeable by the manufacturer.

This document is not applicable to machines 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 2041, *Mechanical vibration, shock and condition monitoring — Vocabulary*

ISO 2631-1, *Mechanical vibration and shock — Evaluation of human exposure to whole-body vibration — Part 1: General requirements*

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

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

ISO 3411, *Earth-moving machinery — Physical dimensions of operators and minimum operator space envelope*

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ISO 3449, *Earth-moving machinery — Falling-object protective structures — Laboratory tests and performance requirements*

ISO 3450:2011, *Earth-moving machinery — Wheeled or high-speed rubber-tracked machines — Performance requirements and test procedures for brake systems*

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

ISO 3471, *Earth-moving machinery — Roll-over protective structures — Laboratory tests and performance requirements*

ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards*

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

ISO 3747, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Engineering/survey methods for use in situ in a reverberant environment*

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

ISO 3864 (all parts), *Graphical symbols — Safety colours and safety signs*

ISO 4302, *Cranes — Wind load assessment*

ISO 4309, *Cranes — Wire ropes — Care and maintenance, inspection and discard*

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

ISO 4414, *Pneumatic fluid power — General rules and safety requirements for systems and their components*

ISO 4871, *Acoustics — Declaration and verification of noise emission values of machinery and equipment*

ISO 5006, *Earth-moving machinery — Operator's field of view — Test method and performance criteria*

ISO 5010, *Earth-moving machinery — Wheeled machines — Steering requirements*

ISO 5149-2, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

ISO 5349 (all parts), *Mechanical vibration — Measurement and evaluation of human exposure to hand-transmitted vibration*

ISO 6395, *Earth-moving machinery — Determination of sound power level — Dynamic test conditions*

ISO 6405 (all parts), *Earth-moving machinery — Symbols for operator controls and other displays*

ISO 6682, *Earth-moving machinery — Zones of comfort and reach for controls*

ISO 6683, *Earth-moving machinery — Seat-belt assemblies and seat-belt anchorages — Performance requirements and tests*

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

ISO 7001[1)], *Graphical symbols — Registered public information symbols*

ISO 7010, *Graphical symbols — Safety colours and safety signs — Registered safety signs*

ISO 7096, *Earth-moving machinery — Laboratory evaluation of operator seat vibration*

ISO 7731, *Ergonomics — Danger signals for public and work areas — Auditory danger signals*

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

ISO 9533, *Earth-moving machinery — Machine-mounted audible travel alarms and forward horns — Test methods and performance criteria*

ISO 9614-2, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning*

ISO 10263 (all parts), *Earth-moving machinery — Operator enclosure environment*

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

ISO 10532, *Earth-moving machinery — Machine-mounted retrieval device — Performance requirements*

ISO 10570, *Earth-moving machinery — Articulated frame lock — Performance requirements*

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

ISO 11112, *Earth-moving machinery — Operator's seat — Dimensions and requirements*

ISO 11200, *Acoustics — Noise emitted by machinery and equipment — Guidelines for the use of basic standards for the determination of emission sound pressure levels at a work station and at other specified positions*

ISO 11201:2010, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions in an essentially free field over a reflecting plane with negligible environmental corrections*

ISO 11203, *Acoustics — Noise emitted by machinery and equipment — Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

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ISO 11428, *Ergonomics — Visual danger signals — General requirements, design and testing*

ISO 12001, *Acoustics — Noise emitted by machinery and equipment — Rules for the drafting and presentation of a noise test code*

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

ISO 12509, *Earth-moving machinery and rough-terrain trucks — Lighting, signalling and marking lights, and reflex reflectors*

ISO 13333, *Earth-moving machinery — Dumper body support and operator's cab tilt support devices*

ISO 13459, *Earth-moving machinery — Trainer seat — Deflection limiting volume, space envelope and performance requirements*

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 13849-2, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation*

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

ISO 13851, *Safety of machinery — Two-hand control devices — Principles for design and selection*

ISO 13855, *Safety of machinery — Positioning of safeguards with respect to the approach of the human body*

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ISO 13856-2, *Safety of machinery — Pressure-sensitive protective devices — Part 2: General principles for design and testing of pressure-sensitive edges and pressure-sensitive bars*

ISO 13856-3, *Safety of machinery — Pressure-sensitive protective devices — Part 3: General principles for design and testing of pressure-sensitive bumpers, plates, wires and similar devices*

ISO 14118, *Safety of machinery — Prevention of unexpected start-up*

ISO 14119, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

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

ISO 15442, *Cranes — Safety requirements for loader cranes*

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

ISO 20474-5, *Earth-moving machinery — Safety — Part 5: Requirements for hydraulic excavators*

ISO 22448, *Earth-moving machinery — Anti-theft systems — Classification and performance*

ISO 22932-5, *Mining — Vocabulary — Part 5: Drilling and blasting*

ISO 23875, *Mining — Air quality control systems for operator enclosures — Performance requirements and test methods*

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

IEC 60204-11, *Safety of machinery — Electrical equipment of machines — Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV*

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IEC 60417[2)], *Graphical symbols for use on equipment*

IEC 60825-1, *Safety of laser products — Part 1: Equipment classification and requirements*

IEC 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6–2: Generic standards — Immunity for industrial environments*

IEC 61000-6-4, *Electromagnetic compatibility (EMC) — Part 6–4: Generic standards — Emission standard for industrial environments*

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

IEC 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking*

IEC 61851-1, *Electric vehicle conductive charging system — Part 1: General requirements*

IEC 62196 (all parts), *Plugs, socket-outlets, vehicle connectors and vehicle inlets — Conductive charging of electric vehicles*

IEC 62443-3-3, *Security for industrial automation and control systems Part 3-3: System security requirements and security levels*

IEC 62485-6, *Safety requirements for secondary batteries and battery installations — Part 6: Safe operation of lithium-ion batteries in traction applications*

2) Available at: https://std.iec.ch/iec60417

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IEC 62619, *Secondary cells and batteries containing alkaline or other non-acid electrolytes — Safety requirements for secondary lithium cells and batteries, for use in industrial applications*

IEC 62620, *Secondary cells and batteries containing alkaline or other non-acid electrolytes — Secondary lithium cells and batteries for use in industrial applications*

IEC 62745, *Safety of machinery — Requirements for cableless control systems of machinery*

ISO/IEC 80079-38, *Explosive atmospheres — Part 38: Equipment and components in explosive atmospheres in underground mines*

EN 280-1, *Mobile elevating work platforms — Design calculations — Stability criteria — Construction — Safety — Examinations and tests*

EN 378-2, *Refrigerating systems and heat pumps — Safety and environmental requirements — Part 2: Design, construction, testing, marking and documentation*

EN 474-5, *Earth-moving machinery — Safety — Part 5: Requirements for hydraulic excavators*

EN 842, *Safety of machinery — Visual danger signals — General requirements, design and testing*

EN 1889-2, *Machines for underground mines — Mobile machines working underground — Safety — Part 2: Rail locomotives*

EN 12999, *Cranes — Loader cranes*

EN 14492-1, *Cranes — Power driven winches and hoists — Part 1: Power driven winches*

EN 14492-2, *Cranes — Power driven winches and hoists — Part 2: Power driven hoists*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 2041, ISO 3450, ISO 3740, ISO 3864, ISO 4871, ISO 7010, ISO 9244, ISO 11200, ISO 11201, ISO 12100, ISO 14120, ISO 22932-5 and IEC 60204-1 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 https://www.electropedia.org/

— IEC Glossary: available at std.iec.ch/glossary

4 Safety requirements

4.1 General requirements

4.1.1 General

Machinery shall conform to the safety requirements of this document. In addition, the machine shall be designed in accordance with the principles of ISO 12100 for hazards which are not dealt with by this document.

4.1.2 Handling of the machine and its parts

4.1.2.1 Manual handling

Components that require manual handling during operation shall be in accordance with Table 1.

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Table 1 — Manual handling of components

Component mass	Requirement
<15 kg	shape that facilitates manual handling
≥15 kg	provisions for lifting

NOTE The component mass threshold value corresponds to the guidance given in ISO 11228-1.

Loader cranes shall conform to ISO 15442 or EN 12999.

4.1.2.2 Attachment points

The machine shall have the attachment points for

a) lifting the whole machine, or parts of it, and

b) anchoring the machine on the means of transport.

The attachment points shall conform to ISO 15818.

4.1.2.3 Retrieval points

Retrieval points (hooks, ears, etc.) shall be provided on the machine. They shall be designed for the forces applicable to the working conditions and conform to ISO 10532.

The retrieval points may also be used for holding and securing the machine during transport.

4.1.2.4 Articulation frame lock

On articulated carriers there shall be a mechanical locking device for locking the articulation joint during maintenance, lifting and transport. The articulation frame lock shall conform to ISO 10570.

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4.1.2.5 Booms, stabilizers, outriggers, jacks and movable devices

Stabilizers, outriggers, jacks, and other movable devices, that can cause a hazard during transportation if moved out of position, shall be lockable in their transport position.

Booms, stabilizers, outriggers, jacks and other movable devices shall have distinctive mechanical end stops or provide visual confirmation that they are in transport position.

4.1.2.6 Specific equipment

If the adjustment, maintenance, or use of the machine requires the use of equipment or accessories that are specific to the machinery concerned, such equipment or accessories shall be made available by the machinery manufacturer with the machine.

4.1.2.7 Guards

Guards and other means of protecting personnel from mechanical, fluid, or thermal hazards associated with the operation and routine maintenance of the carrier machine shall conform to ISO 3457.

The engine compartment shall be guarded against unauthorised access by one of the following means:

a) a locking device;

b) a barrier to entry that requires the use of a tool or key;

c) a guard latch control inside a lockable compartment (for example in the operator enclosure).

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4.1.3 Access to operating positions and service points

Access systems shall be provided to operator stations, operating positions and to routine maintenance points.

Access systems and emergency exits shall conform to ISO 2867.

Minimum access dimensions shall conform to ISO 2860.

The access system shall accommodate operators wearing heavy gloves, footwear and other specified personal protective equipment.

4.1.4 Electrical equipment

The electrical equipment of the machine shall conform to

a) IEC 60204-1 for nominal supply voltages not exceeding 1 000 V for alternating current (AC) and not exceeding 1 500 V for direct current (DC), and with nominal supply frequencies not exceeding 200 Hz, and

b) IEC 60204-11 for nominal voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV AC or DC with nominal frequencies not exceeding 60 Hz.

4.1.5 Electromagnetic compatibility (EMC)

Machines shall conform to the EMC requirements of

— ISO 13766-1 and ISO 13766-2

or

— IEC 61000-6-2 and IEC 61000-6-4. See also IEC 61000-6-7.

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Electrical components and sub-systems used should conform to the EMC standards relevant to the component type, sub-system, or the industry they are sourced from.

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4.1.6 Lighting

4.1.6.1 Working light

For manned machines specified to work in darkness and non-lit conditions, the machine shall be fitted with working light illuminating the area around the typical drilling operation of the application. It shall give a minimum illumination of 100 lx at the typical working area apart from natural shadows from feeds and booms.

Internal parts requiring inspection, adjustment or maintenance shall have

— built-in internal lighting, or

— be equipped with a socket for plugging in a lamp, or

— a fixed rechargeable handheld flashlight at the operator station.

4.1.6.2 Illumination for tramming

For self-propelled machines tramming in darkness, lighting shall be provided giving an illumination of at least 10 lx at a distance of 7 m in front of and behind the machine when all positioning units are in their tramming or travelling position.

The distance shall be measured from the foremost and rearmost parts of the machine.

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