
**Underground mining machines —
Mobile extracting machines at the face
— Safety requirements for shearer
loaders and plough systems**

*Machines d'exploitation de mines et carrières souterraines —
Machines mobiles d'abattage de front de taille — Exigences de
sécurité imposées aux haveuses à tambour(s) et aux rabots*

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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).

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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

The committee responsible for this document is ISO/ TC 82, *Mining*.

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Introduction

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

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 machines concerned work with tools for cutting minerals such as coal, ore, salt and surrounding rock, at a fixed or variable height and are guided on armoured face conveyors or their attachments. Shearer loaders have built-in haulage systems. They can be directly operated by one or more drivers or be remotely or program controlled. Plough systems are remotely controlled. Wireless remote control systems of shearer loaders are used in the immediate environment of the machines.

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Underground mining machines — Mobile extracting machines at the face — Safety requirements for shearer loaders and plough systems

1 Scope

This document specifies safety requirements to minimize the hazards listed in [Clause 4](#) that can occur during the assembly, use, maintenance, repair, decommissioning, disassembly and disposal of shearer loaders and plough systems when used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer, in underground mining.

This document does not cover any hazards resulting from explosive atmospheres. Requirements for explosive atmospheres can be found in ISO/IEC 80079-38.

This document is not applicable to machines that 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 3457:2003, *Earth-moving machinery — Guards — Definitions and requirements*

ISO 3864-3, *Graphical symbols — Safety colours and safety signs — Part 3: Design principles for graphical symbols for use in safety signs*

ISO 4413:2010, *Hydraulic fluid power — General rules and safety requirements for systems and their components*

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

ISO 7731:2003, *Ergonomics — Danger signals for public and work areas — Auditory danger signals*

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

ISO 9355-1, *Ergonomic requirements for the design of displays and control actuators — Part 1: Human interactions with displays and control actuators*

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

ISO 12922, *Lubricants, industrial oils and related products (class L) — Family H (Hydraulic systems) — Specifications for hydraulic fluids in categories HFAE, HFAS, HFB, HFC, HFDR and HFDU*

ISO 13732-1, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces*

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

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

IEC 60204-1:2005, *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 HV equipment for voltages above 1000 V a.c. or 1500 V d.c. and not exceeding 36 kV*

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

IEC 60947-1, *Low-voltage switchgear and controlgear — Part 1: General rules*

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

IEC 61439-1, *Low-voltage switchgear and controlgear assemblies — Part 1: General rules*

IEC 61439-2, *Low-voltage switchgear and controlgear assemblies — Part 2: Power switchgear and controlgear assemblies*

IEC 61439-4, *Low-voltage switchgear and controlgear assemblies — Part 4: Particular requirements for assemblies for construction sites (ACS)*

3 Terms and definitions

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

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

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

— ISO Online browsing platform: available at <http://www.iso.org/obp>

3.1

remote control

operating mode where the operator controls the moving machine from a fixed position outside of the working area of the machine

3.2

radio control

operating mode where the operator controls the moving machine from within the working area of the machine by means of mobile radio transmitters

3.3

working area

operating area of the machine, consisting of the face and the roadway junctions

3.4

load attachment point

means of attachment for devices to enable them to carry a load

3.5

transport units

parts or subassemblies which, for transportation reasons, are not fitted to the complete machine until the point of use

3.6

energizing

introducing power to the machine without starting or operating of the machine

3.7 starting

activating the machine without necessarily causing the machine to move

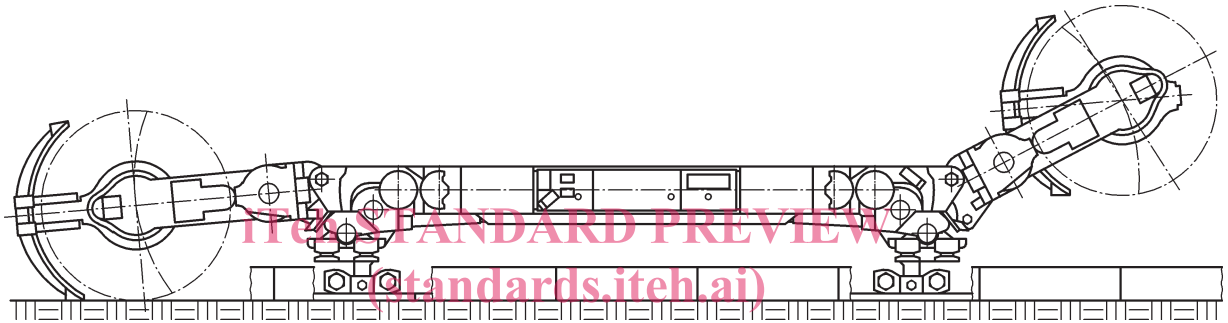
Note 1 to entry: For example, a shearer loader is started up when the hydraulic pump drive is switched on but externally the machine has clearly not yet moved.

3.8 cutting cycle

operation of the shearer or plough, from one end of the face to the other and back, including the face-end operations

4 List of significant hazards

This clause lists the hazards, hazardous situations and events, as far as they are dealt with in this document, identified as significant for shearer loaders (see [Figure 1](#)) and plough systems (see [Figure 2](#)) and which require an action to eliminate or reduce the risk, see [Table 1](#).



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Figure 1 — Shearer loader (side view)
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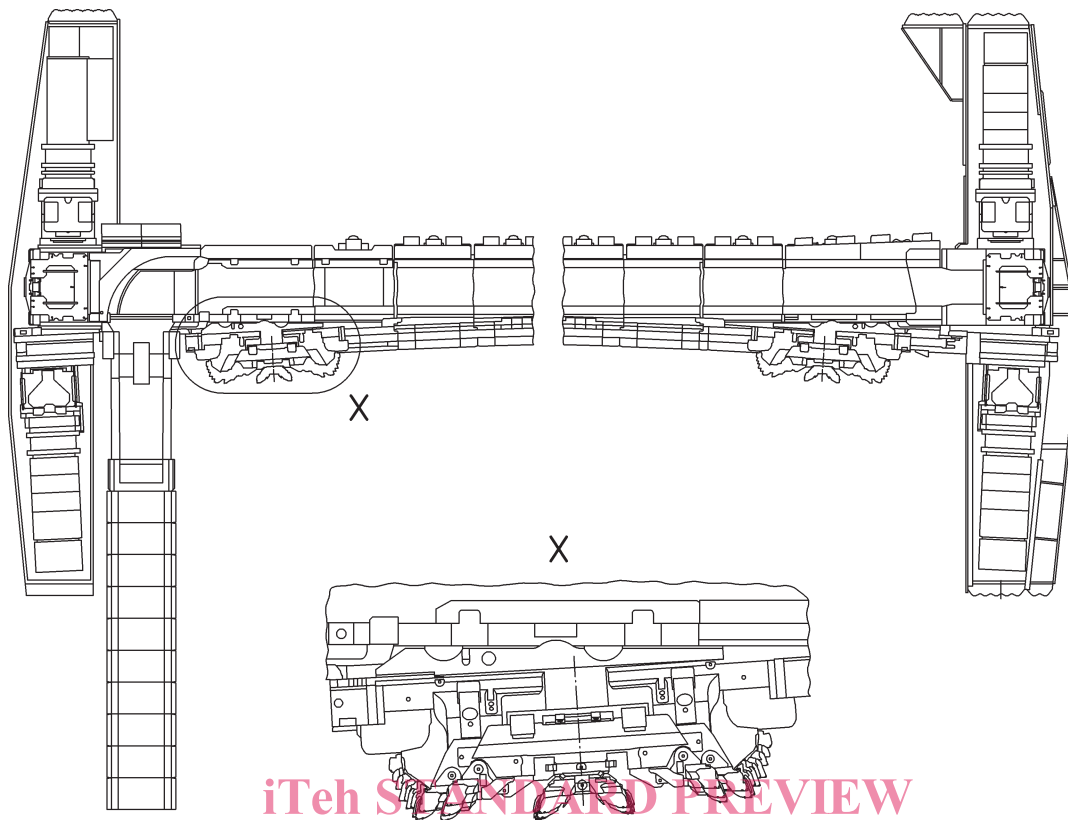


Figure 2 — Plough system (top view)

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Table 1 — List of significant hazards with associated requirements

Hazard	Shear-er-loader	Plough system	Sub-clause
1. Mechanical hazards			
— crushing or shearing between machine parts or between machine parts and their surrounding	X	X	5.4.8 5.5 5.9 5.10 5.12 5.13
— drawing into moving cutting tools, drive wheels, trailing cables and chains	X	X	5.8.4 5.9 5.10
— skidding or inadvertent movement of the machine and parts of it	X	X	5.4.8
— whipping or breaking chains	X	X	5.9
— insufficient stability	X	X	5.3
2. Thermal hazards			
— scalding by fluids	X	X	5.9.3 5.10.1
— burning due to hot surfaces	X	X	5.2.2 5.9.3

Table 1 (continued)

Hazard	Shear-er-loader	Plough system	Sub-clause
3. Fire hazards			
— burning due to open flames	X	X	5.11
4. Hazards generated by materials and other substances released when machinery is used			
— spalling of cut material or cutting tools	X	X	5.5
— fluids harmful to health	X	—	5.10.1
— dust harmful to health	X	X	5.6
5. Hazards generated by neglecting ergonomic principles in machine design			
— personal injury and damage to hoses and cables	X	X	5.2.1
— controls that cannot be operated when operator is wearing protective gloves	X	X	5.4.1
— unhealthy postures or excessive effort	X	X	5.4.1 5.12
— personal injury due to excessive noise	X	X	5.7
6. Hazards generated by power supply faults and other failures			
— spraying of fluids at high pressure	X	X	5.10
— hydraulic pressure drop	X	X	5.10.1
— control system failure	X	X	5.4
— falling objects	X	X	5.12
— injury due to electrical energy	X	X	5.8
7. Hazards generated by temporary absence of protective measures			
			5.4
			5.7
— personal injury or damage to machinery	X	X	5.8 5.10 5.13
8. Hazard due to errors of fitting			
— personal injury or damage to machinery	X	X	5.13

5 Safety requirements and/or protective measures

5.1 General

Shearer loaders and plough systems shall comply with the safety requirements and/or protective measures of this clause.

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

5.2 Contact surfaces

5.2.1 Sharp corners and edges

Accessible parts of the machines shall be designed and manufactured to minimize sharp edges, angles or rough surfaces which are likely to cause injury, see ISO 12508.

5.2.2 Hot surfaces

Where there is a risk of contact with hot surfaces in accessible areas, suitable measures shall be taken in accordance with ISO 13732-1.

This requirement does not apply to the excavation tools.

5.3 Stability

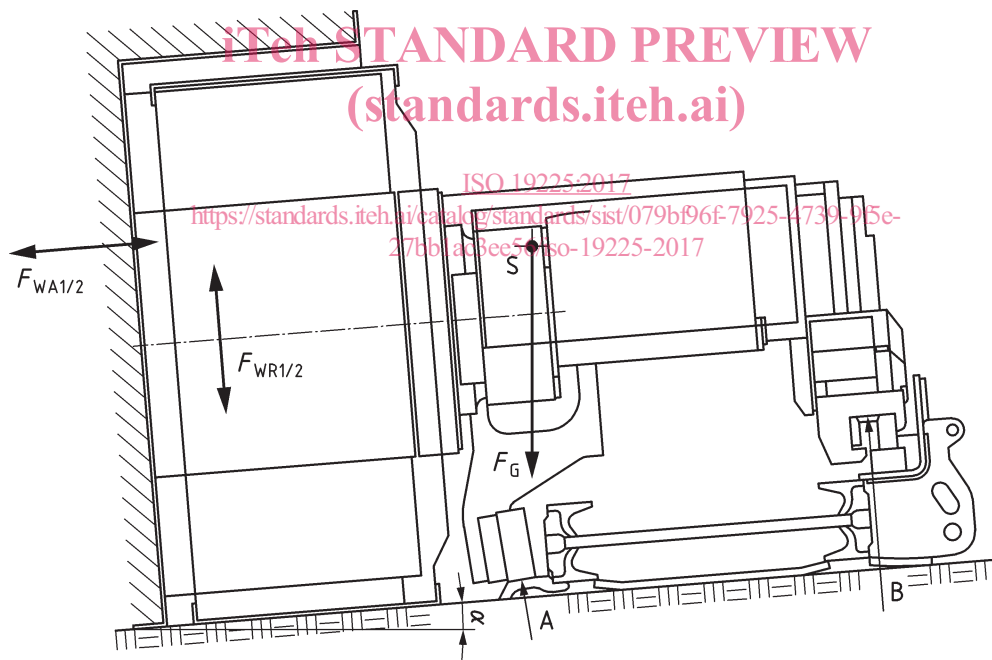
The manufacturer shall specify limit values for the permissible tilting of the machines in all directions. This is to avoid possible instability of the shearer during operation or while standing, which could cause injury to personnel within the area of the machine.

To evaluate the stability of shearer loaders, the forces acting on the two cutting drums and the weight of the machine simplified in the transverse plane to the machine are taken into account (see Figure 3).

The size of the forces and their directions as well as the distance to the bearing points A + B shall be determined by the manufacturer.

At least one of the bearing points A + B shall be designed as a form-fit bearing to absorb vertical as well as horizontal forces.

The maximum permissible inclination of the machine in longitudinal and transverse direction has to be determined by the manufacturer and indicated in the operating manual.



- Key**
- A, B loading pads
 - S centre of gravity
 - F_G machine weight
 - $F_{WR1,2}^{a)}$ forces on the cutting drums, radial
 - $F_{WA1,2}$ forces on the cutting drums, axial
 - α angle of transverse dip
 - a) 1 and 2 as a function of the direction of rotation.

Figure 3 — Example of forces on the shearer loader