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Shot blasting machinery — safety and environmental requirements

Équipements de grenailage — Prescriptions de sécurité et de l'environnement

ICS: 77.180; 13.110

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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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 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 306, *Foundry machinery*.

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 and also deals with aspects of environmental impact and energy efficiency.

The design, the construction and the actual operation of shot blasting machinery affects aspects of safety, energy usage and environmental impact. These may influence each other or may be in conflict to each other. The safety requirements defined in this standard override the requirements defined for minimizing energy usage and environmental impact.

The machinery concerned and the extent to which hazards, hazardous situations and hazardous events are covered are indicated in the scope of this document. When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

Where for clarity an example of a preventative measure is given in the text, this should not be considered as the only possible solution. Other solutions can be used as far as they fulfil correctly the criteria expressed in the requirement.

This document assumes, that the shot blasting machinery is operated and maintained by trained personnel.

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Shot blasting machinery — safety and environmental requirements

1 Scope

This standard deals with shot blasting machinery.

This standard covers

- all significant hazards, hazardous situations and hazardous events relevant to shot blasting machinery, when used as intended and under the conditions foreseen by the manufacturer, including reasonably foreseeable misuse;
- measures for minimization of environmental impact and energy usage of shot blasting machinery.

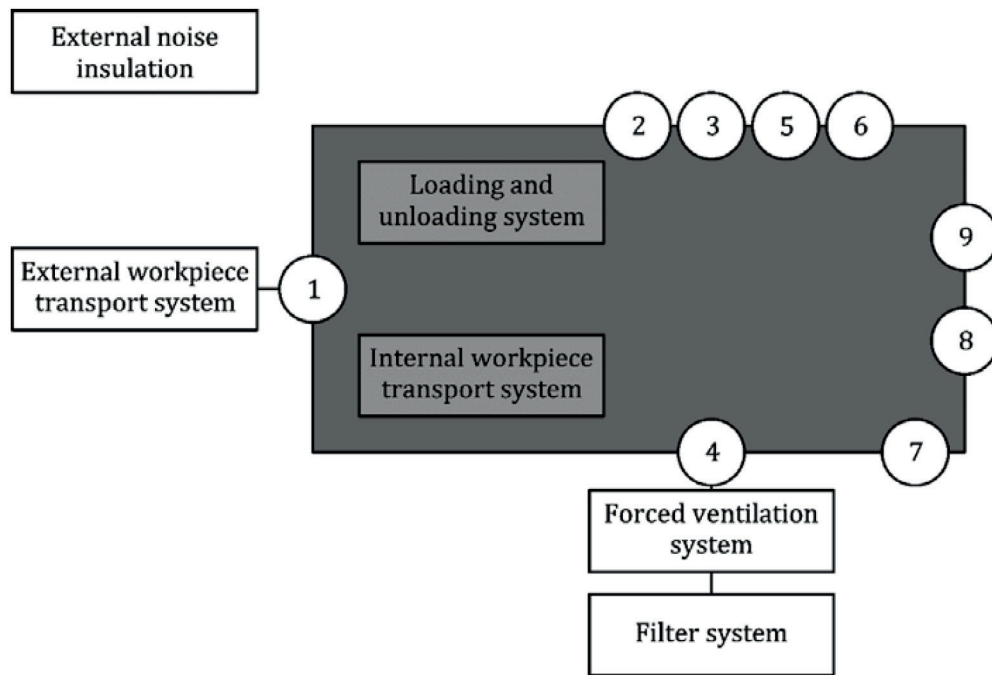
Shot blasting machinery covers

- wheel blasting machinery;
- air blasting machinery for dry and wet blasting;
- combined wheel and air blasting machinery.

Interfaces between shot blasting machinery and other equipment used in shot blasting but not in scope of this standard are given in [Figure 1](#).

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Key



shot blasting machinery



equipment out of scope

- 1 mechanical and electrical interface to external workpiece transport system
- 2 connector to electrical energy supply
- 3 connector to fresh air supply ducting
- 4 connector to exhaust air ducting
- 5 connector to pressurized air supply
- 6 connector to water supply
- 7 connector to waste water system
- 8 interface for safe exchange of control signals
- 9 connector for fresh air supply for respiratory protection device (in blast rooms)

Figure 1 — Interfaces of shot blast machinery to ancillary machinery

The specific significant risks related to mobile and movable shot blasting machinery (e. g. shot blasting machines designed for operation at changing locations) are not dealt with in this standard.

This standard does not apply to

- high pressure water jet machinery;
- dry-ice blasting machinery.

This standard is not applicable to shot blasting machines manufactured before the date of its publication as ISO standard.

NOTE The requirements defined in this standard may serve as a guideline for a risk assessment of shot blasting machines manufactured before the date of its publication as ISO standard.

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 3744:2010, *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 3746:2010, *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane*

ISO 3864-1:2011, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs and safety markings*

ISO 7000:2014, *Graphical symbols for use on equipment — Registered symbols*

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

ISO 9614-1:1993, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points*

ISO 9614-2:1996, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning*

ISO 10218-2:2011, *Robots and robotic devices — Safety requirements for industrial robots — Part 2: Robot systems and integration*

ISO 11161:2010, *Safety of machinery - Integrated manufacturing systems - Basic requirements*

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

ISO 13849-1:2015, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13850:2015, *Safety of machinery — Emergency stop function — Principles for design*

ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection*

ISO 14120:2015, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

ISO 14122-2:2016, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways*

ISO 14122-3:2016, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails*

IEC 60204-1:2016, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*

IEC/TS 60079-32-1:2017, *Explosive Atmospheres — Part 32-1: Electrostatic hazards, guidance*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 12100:2010 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

external workpiece transport system

system that transports the workpiece to or from the shot blasting machine

3.2

internal workpiece transport system

system that transports the workpiece within the shot blasting machine

3.3

wheel blaster

device which accelerates the shot blasting media by a rotating wheel with blades

3.4

air blaster

assembly consisting of a nozzle and connected hose(s) or tube(s), which accelerates the shot blasting media by pressurized air

3.5

accessible blasting chamber

blasting chamber which, by designated use, is designed to be entered by personnel

3.6

workspace

workplace for the operator as defined by the manufacturer of the shot blasting machine

3.7

interior workspace

workspace inside of a shot blasting machine

3.8

screw conveyor

device that uses a rotating helical blade to move shot blasting media, horizontally or at a slight incline

3.9

belt conveyor

endless belt between two, or more, pulleys to move shot blasting media or products, horizontally or incline

3.10

vibrating conveyor

device that transports shot blasting media or products by using vibration and gravity

3.11

scraper conveyor

device to transport bulk shot blasting media over a floor with the help of scrapers

3.12

hopper

container for storing shot blasting media or for providing or replenishing shot blasting media for the shot blasting process

3.13

bucket elevator

vertical belt conveyor where buckets fixed to the belt transporting shot blasting media up to a desired height

3.14**hopper discharge conveyor**

mechanical device, screw conveyor, belt conveyor or other suitable transport system, to feed shot blasting media from the hopper to the shot blasting machine

3.15**switch valve**

device for closing or opening the shot blasting media flow to the shot blasting process, where operating the valve can be electrical, pneumatical or magnetical

3.16**magnetic separator**

system, mostly operating with partial magnetic drums, where a ferromagnetic- and non-ferromagnetic mixture is separated to obtain reusable shot blasting media for the shot blasting process

3.17**cleaning system**

device to separate small particles from shot blasting media, to obtain a required mixture, mostly combined with a sieve for separating large particles

4 Significant hazards, environmental impact and energy usage**4.1 General**

The variety of machinery could not be covered in all details in a standard. To deal with this fact, an individual risk assessment of the machinery in question shall be carried out considering the safety requirements of this document.

Significant hazards identified in this individual risk assessment but not dealt with in this standard shall be avoided respectively reduced by applying the principles of ISO 12100:2010.

If combinations of machines and/or machine functions described at different parts of the standard are located in the same danger zone, the different measures shall be considered together.

4.2 Significant hazards

[Clause 5](#) gives requirements to prevent or minimise all hazards, hazardous situations and events identified by risk assessment as significant for this type of machinery.

See ISO 12100:2010 for measures against hazards that are relevant but not significant for this machine type.

NOTE ISO 12100:2010 contains information for the procedure of risk assessment.

4.3 Environmental impact and energy usage

[Clause 6](#) contains measures for minimization of

- environmental impact and
- energy usage.

5 Safety requirements, protective measures, risk reduction measures**5.1 General**

Shot blasting machinery shall comply with the safety requirements and/or protective measures against the significant hazards given in [Clause 5](#). In addition, shot blasting machinery shall be designed

according to the principles of ISO 12100:2010 for relevant hazards which are not dealt with by this document.

Warning devices and safety signs shall be in accordance with ISO 3864-1:2011, ISO 7000:2014 or ISO 7731:2003.

5.2 Guards and doors

If access to a work area is limited by separating guards/doors, these shall be secured by the safety-related control system according to the performance level given in [Table 1](#).

All other potential accesses to hazardous areas shall be secured by guards in accordance with ISO 13857:2008, ISO 14120:2015 and ISO 14119:2013.

5.3 Electrical equipment

Electrical equipment of shot blasting machinery shall comply with IEC 60204-1:2016.

5.4 Noise

By design and construction, the emission of noise shall be minimized. Technical progress and the availability of means for noise reduction, in particular at the source, shall be taken into account.

NOTE 1 ISO/TR 11688-1:1995 gives general technical information on widely recognized technical rules and means for design and construction of low-noise machinery.

NOTE 2 ISO/TR 11688-2:1998 gives useful information on noise generation mechanisms in machinery and equipment.

See ISO 3744:2010, ISO 3746:2010, ISO 9614-1:1993, ISO 9614-2:1996 for requirements for noise measurement.

NOTE 3 Noise emissions limit values to air are subject to national regulation.

5.5 Emergency stop

Emergency stop devices shall comply with ISO 13850:2015.

5.6 Control systems

Safety related control systems shall be designed according to ISO 13849-1:2015. This applies also for input and processing of safety related parameters (e. g. operating parameters).

Table 1 — Required performance level (PLr) for control systems of shot blasting machinery

Safety function	Clause	PLr
Guard locking of access points of wheelblasters by interlocking movable guards associated with an interlocking device interlocked with the hazardous movement and a guard locking device	5.2 5.7, Table 2 , row 1 5.7, Table 3 , row 1	d
Guard locking of access points of wheel blasters by fixed guards associated with an interlocking device interlocked with the hazardous movement	5.2 5.7, Table 2 , row 1 5.7, Table 3 , row 1	c
Guard locking of access to blasting chamber of wheel blasting machines without additional safety measures	5.2 5.7, Table 2 , row 2 5.7, Table 3 , row 1	d