SLOVENSKI STANDARD
oSIST prEN ISO 23062:2019

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Livarski stroji - Varnostne zahteve za stroje za oblikovanje in modeliranje ter pripadajočo opremo (ISO/DIS 23062:2019)

Foundry machinery - Safety requirements for molding and coremaking machinery and associated equipment (ISO/DIS 23062:2019)

Sicherheitsanforderungen an Gießereimaschinen und -anlagen der Form- und Kernherstellung und dazugehörige Einrichtungen (ISO/DIS 23062:2019)

Machines de fonderie - Exigences de sécurité applicables aux machines, installations et équipements annexes pour le moulage et le noyautage en fonderie (ISO/DIS 23062:2019)

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Foundry machinery — Safety requirements for molding and coremaking machinery and associated equipment

Machines de fonderie — Exigences de sécurité applicables aux machines, installations et équipements annexes pour le moulage et le noyautage en fonderie

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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.

This document was prepared by Technical Committee ISO/TC 306, *Foundry machinery*, WG 2, Safety requirements for molding and coremaking equipment.

Introduction

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

NOTE ISO 12100 is the basis for a set of standards which has the following structure: **type-A standards** (basic safety standards) giving basic concepts, principles for design and general aspects that can be applied to machinery, **type-B standards** (generic safety standards) dealing with one safety aspect or one type of safeguard that can be used across a wide range of machinery and **type-C standards** (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

The machinery concerned and the extent to which hazards, hazardous situations and 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 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 preventive measure is given in this document, this should not have been considered as the only possible solution. Any other solution leading to the same risk reduction is permissible if an equivalent level of safety is achieved.

It is assumed that the machinery according to the scope is operated and maintained by trained personnel (see 3.24).

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 organizations, 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 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.

Foundry machinery — Safety requirements for molding and coremaking machinery and associated equipment

1 Scope

This document applies to the following equipment:

a) Machinery constructed to condition and/or reclaim foundry sands for mold and core making (including related moldablegranular materials);

b) Molding machinery;

c) Coremaking machinery;

d) Knock-out equipment;

e) Other directly associated equipment.

This document does not apply to

— ladles and pouring equipment

NOTE This equipment is covered within EEC by EN 1247.

— wax- and lost foam pattern production and wax removal equipment;

— additive manufacturing equipment;

— dust and/or gaseous emissions reduction equipment;

— crane installations;

— winches;

— continuous conveyors or handling systems which could be an integral part of the equipment covered by the scope.

This document deals with foreseeable significant hazards, hazardous situations and events relevant to molding and coremaking machinery and associated equipment when used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer. It provides the requirements to be met by the manufacturer to ensure the safety of persons and property during the life-cycle phases according ISO 12100:2010; 5.4, as well as in the event of foreseeable failures or malfunctions that can occur in the equipment.

The foreseeable significant hazards are listed in Clause 5 and include:

— Mechanical hazards, movement of machinery and workpieces, ejection of material, of liquids and gases, inadequacy of the mechanical strength;

— Explosion, fire, exothermic reactions;

— Contact with hot parts, gases and flames;

— Noise and vibration;

— Thermal heat radiation and conduction;

— Harmful by-products, poisoning, pollution of operators' breathing air.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

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

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 7010, *Graphical symbols - Safety colours and safety signs - Registered safety signs*

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

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

ISO 11429, *Ergonomics — System of auditory and visual danger and information signals*

ISO/TR 11688-1, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning*

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

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

ISO 13577-2, *Industrial furnaces and associated processing equipment — Safety — Part 2: Combustion and fuel handling systems*

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

ISO 13849-1:2006, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*

ISO 13849-1:2015, *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/DIS 13851:2017, *Safety of machinery — Two-hand control devices — Functional aspects and design principles*

ISO 13854, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

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

ISO/DIS 13857:2017, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs*

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*

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

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

IEC 61496-1, *Safety of machinery — Electro- sensitive protective equipment — Part 1: General requirements and tests*

EN 1265, *Noise test code for foundry machines and equipment*

EN 1299, *Mechanical vibration and shock - Vibration isolation of machines - Information for the application of source isolation*

EN 14253, *Mechanical vibration - Measurement and calculation of occupational exposure to whole-body vibration with reference to health - Practical guidance*

EN 12198-3, *Safety of machinery - Assessment and reduction of risks arising from radiation emitted by machinery - Part 3: Reduction of radiation by attenuation or screening*

IEC 62061:2013, *Safety of machinery - Functional safety of safety-related electrical, electronic and programmable electronic control systems*

IEC 60364, *Electrical Installations for BuildingsIEC 60364*

ISO 6184-1, *Explosion protection systems — Part 1: Determination of explosion indices of combustible dusts in air*

3 Terms and definitions

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

3.1
molding machinery
machines used to make sand molds

Note 1 to entry: There are various machinery types which compact granular molding materials including but not limited to:

— jolt molding machines (compaction by jolting the molding machine deck),

— squeeze molding machines (compaction by squeezing the pattern equipment and the molding sand together),

— jolt and squeeze molding machines,

— shoot-, blow-, fluidisation- and squeeze molding machines,

— impulse molding machines (the molding sand is compacted by a compression wave which acts on the top of the sand fill),

— air-flow-squeeze molding machines (similar to impulse-molding machines, except that the compressed air escapes through nozzles in the pattern plate),

— dynamic squeeze molding machines (compensating pressure squeeze pistons act on the top of the sand fill),

— suction and squeeze molding machines (the pressure differential between the molding box and the pattern draws in the molding sand),

— vacuum-molding machines (unbonded sand is compacted by vacuum),

— sand slingers (the molding sand is flung into the molding box by the centrifugal force of a rotating wheel).

3.2
molding line
equipment used to make ready-to-pour sand molds

Note 1 to entry: A moldingline consists of molding stations (automatic molding machines for complete molds) or several molding machines (molding group) that produce the molding parts separately. It may also include lines for core setting, mold closing, weighting or clamping, pouring, cooling, knocking-out of the mold parts and emptying of the boxes as well as integral transfer systems linking the various stations and lines.

3.3
coremaking machinery
machines used to make solid and/or hollow cores

3.4
core shooters
machines where compressed air is rapidly expanded via the sand reservoir into the sand

Note 1 to entry: After expanding, the sand is then fluidized by the airstream and the sand–air-mix is transported into the core box. Typically used for cold box, hot box and inorganic binder systems.

3.5
coremaking line
equipment used to make ready-to-use single cores and/or core assemblies

Note 1 to entry: A line may consist of,e.g., a sand preparation equipment, core making machine, equipment for handling, deflashing, assembling, coating and drying of cores.

consist of a circular container in which rotating ploughs and/or mill wheels (mullers) are mounted.

3.6
(Continuous) sand mixers
machines in which the sand with bonding agents are continuously mixed and conveyed to the discharge gate

Note 1 to entry: Typically, the mixing takes place by screw-type mixing principles.

3.7
sand aerators
machines used to aerate the mixed sand

Note 1 to entry: E.g., belt aerators (conveyor belt with impact bars) or wheel aerators (drum with impact bars).

3.8
equipment for the storage and pneumatic conveyance of coal dust or coal dust substitutes and their mixtures with bonding agents
silos and pipework that are filled pneumatically with such material and by which the material is supplied pneumatically to the next process step

3.9
sand dryers and heaters
machinery consisting of a heating system and/or subsequent cooling equipment

3.10
reclamation equipment
equipment including storage and conveying facilities used for the reclamation of used sands by mechanical and/or thermal processing means

Note 1 to entry: Machines used to destroy the binder by thermal and/or mechanical and/or chemical/physical means.

3.11
sand lump crushers
machines used to break down lumps of used sand by mechanical means

3.12
magnetic separators
machines used to separate ferro-magnetic material from the used sand

3.13
screening installations
machines used to classify sands and remove unwanted materials

Note 1 to entry: This may be achieved by vibration, rotation or other means.

3.14
gassing equipment
central supply systems and equipment used to produce and/or condition reactive gasses and supply them to the gassing station or intothe sand mixture

Note 1 to entry: Typical processes (binder system/reactive gas) are:

— silicate / CO_2

— urethane (coldbox) /amine

— furane resin; peroxide or epoxy resin; peroxide / SO_2

— alkaline resin / methyl-formate

— inorganic binders / hot air (as dehydration assistance).

3.15
knock-out equipment
equipment used to separate castings from the molding box and/or the mold and/or cores from castings

Note 1 to entry: Typical principles are vibrations on grids and trays.

3.16
punch-out equipment
equipment used to separate the mold and castings from the molding box by vertical or horizontal movement of a punch-out piston

3.17
rotary knock-out and/or cooling drum
rotating or reciprocating machinery through which sand and castings are conveyed and separated

Note 1 to entry: The rolling movement of the castings breaks up the lumps of sand as the drum rotates.

3.18
control modes
single machines or groups of interlinked machines can be operated in different control modes:

Note 1 to entry: This standard distinguishes between control mode(s) and operating mode(s) because there is neither a common understanding nor a definition in EN ISO 12100 and EN 60204-1 corresponds not to the "control mode" of ISO 12100; 6.2.11.9.

3.19
set-up control mode
all the steps within a process can be initiated separately and manually in any sequence

Note 1 to entry: Initiation of individual movements by hold-to-run without interlocked movements. Set-up control mode may enable certain functions of the machinery to be controlled with guards open or with protective devices muted or by means of a special control device such as a pendant control or a remote-control device, instead of the control devices used for normal operation by trained personnel which is authorised for this special task.

3.20
normal operation
it refers to the machine operations during a period (e.g., 8-hour-shift)of regular production and directly production-related human interactions

Note 1 to entry: Directly production-related human interactions are defined as interactions done at least once per shift and does not include repair.

Note 2 to entry: Production-related human interaction during normal operation of moldinglines includes, but is not limited to

— pattern change

— removal of dropped cores and filters

— core, filter and riser setting

— cleaning of tools and/or machinery, if applicable

— spraying release agent and blow cleaning

— visual inspection of mold and pattern.

Note 3 to entry: Production-related human interaction during normal operation of core making lines includes, but is not limited to

— tool change, e.g., core-box, robot gripper, deflashing templates

— removal of dropped cores

— cleaning of tools

— spraying release agent and blow cleaning

— visual inspection of tools

— core unloading.

3.21
maintenance
combination of service and inspection of the equipment

3.21.1
service
measure to maintain the nominal condition

Note 1 to entry: The nominal condition can be maintained in general without dismantling/disassembling major parts of the equipment, e.g. cleaning, lubrication of the work equipment as well as addition or replacement of agents or by replacing tools or operational changing parts.

3.21.2
inspection
measure to observe and assess the current condition as well as fault finding

Note 1 to entry: Measures, e.g. measuring, testing, diagnostics, troubleshooting including the determination of the causes of wear or damage and the derivation of the necessary consequences for the continued use.

3.22
repair
non-regular work, not foreseeable, required to re-establish the nominal condition

Note 1 to entry: Measure to replace damaged parts, requires in general dismantling/disassembling.

3.23
trained person(nel)
skilled person with system knowledge, background knowledge, experience and/or ability to perform a specific task and are aware of the hazards related to their duties

3.24
remote access
machine control mode where faults can be diagnosed, parameters changed, and machine functions can be initiated from a remote location

Note 1 to entry: Collecting data or monitoring machine parameters is not considered as remote access.

Note 2 to entry: Diagnosis by means of passive monitoring of machine parameters is not considered as remote access. Diagnosis by means of active intervention is considered as remote access.

3.25
molding materials
basic granular material for making cores and molds (sand) and powder additives

Note 1 to entry: Sand can contain, e.g., silica, chromite, zircon, syntetical sands.

Note 2 to entry: Powder additives can contain, e.g., bentonite, coal dust, starch, iron oxide, wood flour, silica derivate.

3.26
binders
liquid components for making cores and molds and powder additives

3.27
catalysts
gases or liquid components for making cores and molds

Note 1 to entry: Catalysts can contain, e.g., amines, SO2, methylformiate.

3.28
coatings
liquid or powder components to be added to the surface of cores and molds

3.29
release agents
liquid components to be added to the surface of patterns or core boxes

4 Significant hazards and risk assessment

4.1 General

The hazards, hazardous situations and events identified by risk assessment as significant for the machinery covered by the scope and which require action to eliminate or reduce the risk are listed in Clause 5 (in particular in Tables 1, 2, 3, 4 and 5).

In general, risks and associated hazards are production andline related. The variety of machinery/ linescould not be covered in all details ina standard. To deal with this fact, an individual risk assessment of the machinery/line 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.

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.