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Stroji za predelavo gume in plastike - Sistemi vpenjanja - 1. del: Varnostne zahteve za magnetne vpenjalne sisteme (ISO/DIS 23582-1:2022)

Plastics and rubber machines - Clamping systems - Part 1: Safety requirements for magnetic clamping systems (ISO/DIS 23582-1:2022)

Kunststoff- und Gummimaschinen - Magnetspannsysteme - Sicherheitsanforderungen (ISO/DIS 23582-1:2022)

Machines pour les matières plastiques et le caoutchouc - Systèmes de bridage - Partie 1: Prescriptions de sécurité pour les systèmes de bridage magnétique (ISO/DIS 23582-1:2022)

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Plastics and rubber machines — Clamping systems —

Part 1: Safety requirements for magnetic clamping systems

*Machines pour les matières plastiques et le caoutchouc — Systèmes de bridage —**Partie 1: Prescriptions de sécurité pour les systèmes de bridage magnétique*

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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 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 270, *Plastics and rubber machines*.

This standard is Part 1 of a series of standards on mold clamping systems.

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 standard has been created in recognition of the particular hazards that are presented by Magnetic clamping systems when integrated and installed in a plastics or rubber machine.

Hazards are frequently unique to a particular magnetic clamping system integrated in a plastics or rubber machine. The number and types of hazards are directly related to the nature of the application, the automation process and the complexity of the installation.

The risks associated with these hazards vary with the type of application and production process.

For the purpose of understanding requirements in this standard, a word syntax is used to distinguish absolute requirements from recommended practices or suggested actions. The word “shall” is used to identify requirements necessary for compliance with this standard. Such requirements have to be accomplished unless an alternative instruction is provided, or a suitable alternative is determined by a risk assessment. The word “should” is used to identify suggestions, recommended actions or possible solutions for requirements, but alternatives are possible and the suggested actions are not absolute.

In recognition of the variable nature of hazards with the application of magnetic clamping system integrated in a plastics or rubber machine, this standard provides guidance for the assurance of safety in the design of magnetic clamping systems. Since safety in the use of magnetic clamping systems is influenced by the integration in the machine and by the design and use of the different molds, a supplementary, though equally important, purpose is to provide guidelines for the integration, the installation and the use of magnetic clamping systems.

Providing for a safe magnetic clamping system depends on the cooperation of a variety of “stakeholders” – those entities that share in a responsibility for the ultimate purpose of providing a safe working environment.

Stakeholders may be identified as:

- MCS manufacturer;
- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance etc.);
- machine distributors, resellers, rebuilders and integrators;
- machine users/employers (small, medium and large enterprises);
- machine operators/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e. g. for maintenance (small, medium and large enterprises).

The above-mentioned stakeholder groups have been given the possibility to participate in the drafting process of this document.

All share the common goal of a safe machine. The requirements in this standard may be assigned to one of the stakeholders, but overlapping responsibilities can involve multiple stakeholders in the same requirements. While using this standard, the reader is cautioned that all of the requirements identified may apply to them, even if not specifically addressed by “assigned” stakeholder tasks.

The MCS concerned and the extent to which hazards, hazardous situations or hazardous events are indicated in the Scope of this document.

This document is a type-C standard as stated in ISO 12100:2010.

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.

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Plastics and rubber machines — Clamping systems —

Part 1: Safety requirements for magnetic clamping systems

1 Scope

This document specifies the essential safety requirements for the design, the construction and the integration of magnetic clamping systems (MCS) for plastics and rubber machines (e.g. injection molding machines, compression presses) and provides operational limits and information for their safe use.

This standard deals with the basic hazards, hazardous situations or hazardous events that are listed in [Annex A](#), when an MCS is used utilizing magnetic force to affix a mold to the plate of a machine in which it is integrated, and provides requirements to eliminate or adequately reduce the risks associated with these hazards taking into consideration conditions of misuse that are reasonably foreseeable by the manufacturer.

This standard also specifies requirements for the magnetic clamping system when integrated into a machine. This standard does not deal specifically with hazards associated with production processes or other processes (e.g. horizontal or vertical injection moulding processes). Other standards can be applicable to these process hazards.

This document does not cover hydraulic, pneumatic or mechanical clamping systems.

This standard is not applicable to MCS, 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 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*

IEC 62061:2021, *Safety of machinery - Functional safety of safety-related control systems*

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 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/>

3.1

magnetic clamping system (MCS)

a combination of one or more magnetic plates and a magnetic clamping control system

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- 3.2 magnetic clamping control system**
system to control and monitor the status of the magnetic plate(s)
- 3.3 magnetic plate**
a plate composed of ferromagnetic material including coils, magnets and sensors
- 3.4 magnetic clamping system force**
the force retaining the mold installed on the magnetic plate
- 3.5 ejector force**
the maximum ejector(s) force applied to the installed mold
- 3.6 nozzle force**
the force of the nozzle against the fixed side of the installed mold; this force is relevant only when the mold is open or while opening or closing
- 3.7 magnetic saturation**
state reached when an increase in external magnetic field does not increase the magnetization of the plate further
- 3.8 machine**
plastics and rubber machine where the MCS is integrated
- 3.9 mold change mode**
selectable mode of operation of the machine that allows individual motions at a low speed, low pressure and low force, used for changing the mold
- 3.10 MCS special mode**
mode where the MCS enables machine movements to recover from an MCS alarm, this mode is only available when the machine is in mold change mode and the MCS in alarm
- 3.11 fully automatic machine**
a machine that completes its working cycle without the intervention of an operator between the machine platens
- 3.12 integration**
act of combining a magnetic clamping system with plastics and rubber machines to form a machine system capable of performing useful work such as production of parts.
- Note 1 to entry: Note to entry 1: This act of machine building can include the requirements for the installation of the system.
- 3.13 integrator**
entity that designs, provides, manufactures, assembles or integrates magnetic clamping systems and is responsible for the safety strategy, including the protective measures, control interfaces and interconnections of the control system.
- Note 1 to entry: Note to entry 1: The integrator can be a manufacturer, assembler, engineering company or the user.

4 Safety requirements and/or protective/risk reduction measures

4.1 General

MCS shall comply with the safety requirements and protective measures of this clause. In addition, it shall be designed in accordance with the principles of ISO 12100:2010 for relevant but not significant hazards, which are not dealt with by this document.

The electrical equipment and electromagnetic compatibility of the MCS shall be in accordance with the relevant requirements of IEC 60204-1:2016 including the national differences noted in the foreword of that standard.

The safety related parts of the control systems shall be in accordance with the required performance levels PLr in accordance with ISO 13849-1:2015 or SIL in accordance with IEC 62061:2021, as specified in the relevant sub-clauses.

4.2 Magnets

Only magnets that ensure the mold is held without power after magnetization, shall be used.

4.3 Magnetic plate(s)

Magnetic plate(s) shall be marked to identify which machine platen they affect. At least two separate actions shall be required for magnetization/demagnetization; the actuators used to effect magnetization/demagnetization shall clearly identify which magnetic plates they affect. A visual indicator shall display the magnetic status of the magnetic plate when the MCS is under power.

4.4 Demagnetising/magnetising current

The demagnetising/magnetising current shall be switched off in accordance with PLr=e or SIL=3, see [clause 6.1.4](#).

4.5 Magnetic clamping control system

4.5.1 Magnetic clamping control system detection requirements

The control circuit of the MCS shall detect each of the following conditions:

- the contact of the mold base on the plate in accordance with PLr = b or SIL=1;
- the magnetic state of the plate, in accordance with PLr = d or SIL=2;
- the overtemperature of the magnetic plate, in accordance with PLr = b or SIL=1.

Sensors to detect the presence of the mold shall be monitored during every mold change. If a change of state of sensors is not detected during mold change, magnetization shall be prevented.

The PLr or SIL for each signal provided to the machine control circuit shall be the same as the detection circuit or a single signal can be provided in accordance with PLr=d or SIL=2.

See [6.1.4](#)

4.5.2 Magnetic clamping control system magnetising/demagnetising

The control circuit of the MCS shall allow magnetization or demagnetization only when the MCS receives enable and mold change mode signals from the machine. See [6.1.4](#).

The control circuit of the MCS shall allow magnetization in accordance with PLr=b or SIL=1 when the contact of the mold base on the plate is detected.