



# SLOVENSKI STANDARD

## SIST EN 710:2000

01-april-2000

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### Varnostne zahteve za livarske stroje, stroje za izdelavo jeder in pripadajočo opremo

Safety requirements for foundry moulding and coremaking machinery and plant associated equipment

Sicherheitsanforderungen an Gießereimaschinen und -anlagen der Form- und Kernherstellung und dazugehörige Einrichtungen

Prescriptions de sécurité applicables aux machines et chantiers de moulage et de noyautage en fonderie et a leurs équipements annexes

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#### **ICS:**

25.120.30

Livarska oprema

Moulding equipment

**SIST EN 710:2000**

**en**

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EUROPEAN STANDARD

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Descriptors: moulding equipment, foundry equipment, safety of machinery, dangerous machines, safety requirements, accident prevention, hazardous areas, hazards, safety measures, safety devices, verification, marking, technical notices

English version

## Safety requirements for foundry moulding and coremaking machinery and plant and associated equipment

Prescriptions de sécurité applicables aux machines et chantiers de moulage et de noyautage en fonderie et à leurs équipements annexes

Sicherheitsanforderungen an Gießereimaschinen und -anlagen der Form- und Kernherstellung und dazugehörige Einrichtungen

This European Standard was approved by CEN on 1997-08-02. CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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CEN

European Committee for Standardization  
Comité Européen de Normalisation  
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart, 36 B-1050 Brussels

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## FOREWORD

This European Standard has been prepared by Technical Committee CEN/TC 202 "Foundry machinery", the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 1998, and conflicting national standards shall be withdrawn at the latest by February 1998.

For relationship with EU Directives, see informative Annex ZA, which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

## 0 INTRODUCTION

This European standard is a type C standard as defined in EN 292-1.

The machinery concerned and the extent to which hazards are covered is indicated in the scope of this standard.

In addition, machinery shall comply as appropriate with EN 292-1 and EN 292-2 for hazards which are not covered by this standard and if applicable the other standards referenced in clause 2.

## 1 SCOPE

This standard specifies safety requirements to be met by the manufacturer for machines and plant used in foundries for the production of castings in disposable moulds. It takes into account the foreseeable significant hazards due to design, construction and installation that may occur during commissioning, operation, maintenance and decommissioning. It specifies preventative measures and verification means for the elimination or reduction of these hazards. It specifies requirements for information to be provided by the manufacturer to the user on safe operation and maintenance.

This standard applies to the following equipment:

- Machinery and plant constructed to condition and/or reclaim foundry sands;
- Moulding machinery and plants;
- Coremaking machinery and plants;
- Knock-out equipment;
- Other directly associated equipment.

The foreseeable significant hazards covered 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.

This standard applies to equipment covered by this standard which is placed on the market after the date of issue of this standard.

This standard does not cover the safety requirements for wax- and lost foam pattern production and wax removal equipment and drying ovens.

This standard does not apply to crane installations, winches, continuous conveyors or handling systems which could be an integral part of the above equipment.

The standard does not cover dust reduction equipment.

## 2 NORMATIVE REFERENCES

This European Standard incorporates by dated or undated reference provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

EN 286-1:1991	Simple unfired pressure vessels designed to contain air or nitrogen Part 1: Design, manufacture and testing
EN 292-1:1991	Safety of machinery - Basic concepts, general principles for design Part 1: Basic terminology, methodology
EN 292-2:1991	Safety of machinery - Basic concepts, general principles for design Part 2: Technical principles and specifications
EN 292-2/A1:1995	Safety of machinery - Basic concepts, general principles for design Part 2: Technical principles and specifications
EN 294:1992	Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs
EN 349:1993	Safety of machinery - Minimum distances to avoid crushing of parts of the human body



EN 418:1992	Safety of machinery - Emergency stop equipment, functional aspects - principles for design
ENV 1070	Safety of machinery - Terminology
EN 1088:1995	Safety of machinery - Interlocking devices with and without guard locking General principles and specifications for design
EN 60 204-1:1992	Safety of machinery - Electrical equipment of machines; Part 1: General requirements
EN 61 310-1:1994	Safety of machinery - Indicating, marking and actuating principles - Part 1: Visual, audible and tactile signals
prEN 574:1991	Safety of machinery - Two-hand control device
prEN 614-1:1994	Safety of machinery - Ergonomic design principles Part 1: Terminology and general principles
prEN 746-2:1992	Industrial thermoprocessing equipment - Part 2: Safety requirements for combustion and fuel handling systems
prEN 953:1992	Safety of machinery - Guarding of machinery - Fixed and movable guards
prEN 954-1:1996	Safety of machinery - Safety related parts of control systems Part 1: General principles for design
prEN 982:1995	Safety of machinery - Safety requirements for fluid power systems and their components - hydraulics
prEN 983:1994	Safety of machinery - Safety requirements for fluid power systems and their components - pneumatics
prEN 999:1993	Safety of machinery - hand/arm speed; approach speed of parts of the body for the positioning of safety devices
prEN 1005-2:1995 (2nd revision)	Safety of machinery - Human physical performance Part 2: Manual handling of machinery and component parts of machinery
prEN 1093-1:1993	Safety of machinery - Evaluation of the emission of airborne hazardous substances Part 1: Selection of test methods
prEN 1265:1993	Noise test code for foundry machines and equipment
prEN 1539:1994	Dryers and ovens in which flammable substances are released from coating materials - Safety requirements

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prEN 1921:1995	Industrial automation systems - Safety of integrated manufacturing systems - basic requirements
prEN 50100-1:1992	Safety of machinery - Electro-sensitive protective devices Part 1: Specifications for general requirements
ISO 6184-1:1985	Explosion Protection Systems Part 1: Determination of explosion indices of combustible dusts in air
ISO/TR 11688-1:1995	Acoustics - Recommended practice for the design of low-noise machinery and equipment Part 1: Planning

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### 3 DEFINITIONS

For the purposes of this standard, the definitions given in ENV 1070 apply.

Other terms, definitions and characteristics are as follows:

Term/Type of machine	Definition/Description, Character, Functions
<b>3.1 Moulding</b>	
3.1.1 <u>Moulding machinery</u>	<p>Machines used to make sand moulds. There are various machinery types which compact granular moulding materials including:</p> <ul style="list-style-type: none"> <li>– Jolt moulding machines (compaction by jolting the moulding machine deck),</li> <li>– squeeze moulding machines (compaction by squeezing the pattern equipment and the moulding sand together)</li> <li>– jolt and squeeze moulding machines,</li> <li>– shoot-/blow- and squeeze moulding machines,</li> <li>– impulse moulding machines (the moulding sand is compacted by a compression wave which acts on the top of the sand fill),</li> <li>– air-flow-squeeze moulding machines (similar to impulse-moulding machines, except that the compressed air escapes through nozzles in the pattern plate),</li> <li>– dynamic squeeze moulding machines (compensating pressure squeeze pistons act on the top of the sand fill),</li> <li>– suction and squeeze moulding machines (the pressure differential between the moulding box and the pattern draws in the moulding sand),</li> <li>– vacuum-moulding machines (unbonded sand is compacted by vacuum).</li> <li>– sand slingers (the moulding sand is flung into the moulding box by the centrifugal force of a rotating wheel)</li> </ul>

(continued)

Term/Type of machine	Definition/Description, Character, Functions
3.1.2 <u>Moulding plant</u>	<p>All the equipment used to make ready-to-pour sand moulds. A moulding plant consists of moulding stations (automatic moulding machines for complete moulds) or several moulding machines (moulding group) that produce the moulding parts separately.</p> <p>It may also include lines for core setting, mould closing, weighting or clamping, pouring, cooling, knocking-out of the mould parts and emptying of the boxes as well as integral transfer systems linking the various stations and lines.</p>
3.1.3 <u>Disposable mould</u>	A mould that is destroyed to remove the casting.
<b>3.2 Coremaking</b>	
3.2.1 <u>Coremaking machinery</u>	<p>Machines used to make solid and/or hollow cores.</p> <p>Coremaking machinery is classified into core shooters and core blowers.</p> <p>The principle of core shooting is to rapidly expand compressed air via the sand cylinder into the sand. The cylinder is equipped with openings and a provision for sandfilling (indirect working). The sand is then conveyed along in the airstream.</p> <p>The principle of core blowing is to transport the sand by means of compressed air into the corebox (direct working). The sand is conveyed along in front of the compressed air.</p>
3.2.2 <u>Coremaking plant</u>	<p>All the equipment used to make ready-to-use cores (single cores and/or core assemblies).</p> <p>A plant may consist of a sand preparation plant, coremaking machine, equipment for handling, deflashing, assembling, coating and drying of cores.</p> <p>(continued)</p>

Term/Type of machine	Definition/Description, Character, Functions
<b>3.3 Associated equipment</b>	
<b>3.3.1 <u>Conditioning equipment</u></b>	Equipment and plant used to prepare ready-to-use bonded sands, including equipment for its conveyance and storage.
– Sand mixers and mills	<p>– Machines for batch mixing (blending, coating, kneading) of moulding or core sand with bonding agents, water and complementary mould material additions. The machines are provided with rotating paddles and/or milling rollers and fast rotating paddles for the aeration of the material. Typically, machines consist of a circular container in which are mounted rotating ploughs and/or mill wheels (mullers).</p> <p>– Machines for continuous mixing. These are machines in which the contents are continuously mixed and conveyed to the discharge gate.</p>
– Sand aerators	Machines used to aerate the mixed sand such as belt aerators (conveyor belt with impact bars) or wheel aerators (drum with impact bars).
– Spike disintegrators	<p>Disintegrators with a horizontal or a vertical rotating axis. Used and lump sand is conveyed axially to the disintegrator wheels. The disintegrator wheels are normally provided with projections and rotate in opposite directions.</p>
– Installations for the storage and pneumatic conveyance of coal dust or coal dust substitutes and their mixtures with bonding agents	<p>Silos and pipework that are filled pneumatically with such material and by which the material is supplied pneumatically to the next operation (e.g. sand mixers).</p>
– Sand dryers and heaters	Plant consisting of a heating system and/or subsequent cooling equipment.

(continued)

Term/Type of machine	Definition/Description, Character, Functions										
3.3.2 <u>Reclamation equipment</u>	Equipment and plant including storage and conveying facilities used for the reclamation of used sands by mechanical and/or thermal processing means.										
– Sand lump crushers	Machines used to break down lumps of used sand by mechanical means.										
– Thermal reclamation ovens	Machines used to destroy the binder by thermal means.										
– Mechanical reclamation machines	Machines used to destroy the binder by mechanical means.										
– Magnet separators	Machines used to separate ferro-magnetic material from the used sand.										
– Screening installations	Machines used to classify used sands (this may be achieved by vibration, rotation or other means).										
3.3.3 <u>Gassing equipment</u>	Equipment used to produce and/or condition reactive gasses and supply them to the gassing station or into the sand mixture. Typical processes are:										
	<table> <tr> <th><u>binder system</u></th><th><u>reactive gas</u></th></tr> <tr> <td>- silicate</td><td>CO<sub>2</sub></td></tr> <tr> <td>- urethane</td><td>amine</td></tr> <tr> <td>- furane resin/peroxide or epoxy resin/peroxide</td><td>SO<sub>2</sub></td></tr> <tr> <td>- alkaline resin</td><td>methyl- formate</td></tr> </table>	<u>binder system</u>	<u>reactive gas</u>	- silicate	CO <sub>2</sub>	- urethane	amine	- furane resin/peroxide or epoxy resin/peroxide	SO <sub>2</sub>	- alkaline resin	methyl- formate
<u>binder system</u>	<u>reactive gas</u>										
- silicate	CO <sub>2</sub>										
- urethane	amine										
- furane resin/peroxide or epoxy resin/peroxide	SO <sub>2</sub>										
- alkaline resin	methyl- formate										
3.4 <b>Knock-out equipment</b>	Equipment used to separate castings from the moulding box and/or the mould and/or cores from castings.										
– Punch-out equipment	Equipment used to separate the mould and castings from the moulding box by vertical or horizontal movement of a punch-out piston.										

(continued)

Term/Type of machine	Definition/Description, Character, Functions
– Rotary knock-out and/or cooling drum	A rotating or reciprocating cooling drum through which sand and castings are conveyed and separated. The rolling movement of the castings breaks up the lumps of sand as the drum rotates.
– Knock-out grid	A grid provided with a vibrating facility for the separation of moulding sand from the moulding box and/or from the casting.
– Knock-out tray	Oscillating conveyor for the separation of casting and moulding material.

### 3.5 Modes of operation

- 3.5.1 Setting All the steps within a process can be initiated separately and manually in any sequence.  
Example: mould changing or pattern changing.
- 3.5.2 Manual All the steps within a process can be initiated separately in the sequence of, or out of the sequence of, the programme (e.g. termination of a moulding cycle or continuation of a moulding cycle for testing or fault detection).
- 3.5.3 Semi-automatic Each cycle or part of a cycle is initiated manually and then proceeds to completion in the pre-determined sequence.
- 3.5.4 Automatic Each cycle is initiated by the previous cycle (e.g. continuous operation).

## 4 HAZARDS

Significant hazards are those where the risk of being injured through dangerous movements exists (e.g. squeeze and shear points) or sources of hazard occur (e.g. hazardous materials, conduction and radiation of heat, ejection of metal, explosion, ignition of hydraulic fluids, ejection of sand under pressure, unintended unclamping of elevated parts such as moulding boxes or shooting heads).

An assessment of the foreseeable risks arising from the use of the equipment was carried out when this standard was prepared.

Significant hazards have been condensed in the Scope and have been detailed in the table in clause 5.

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## 5 SAFETY REQUIREMENTS AND MEASURES

The following sub-clauses detail the hazards, hazardous situations and preventative measures relevant to the classes of machinery detailed in 5.2 to 5.5.

Annex C gives examples of the areas on the particular machinery class which are considered to be hazardous and the likely means that could be used to counteract these hazards. Annex A, exemplifies further specific information on the type of preventative measure to be used for certain machinery classes and should be considered in conjunction with the preventative measures specified in 5.2 to 5.5.

Where, for clarity, an example of a safety measure is given in the text this shall not be 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.

### 5.1 General

Machines and equipment shall be designed to eliminate or reduce risks. The purpose of this standard is to assist manufacturers to design their machines and equipment so that the risks arising from their intended use are reduced or eliminated.

The manufacturer shall take into account the requirements of EN 292-2 and EN 60204-1. The safety distances shall be in accordance with EN 294 and EN 349.

**NOTE 1:** Every attempt has been made in this standard to identify all of the relevant risks. However manufacturer should ensure through their own risk assessment that there are no additional risks not covered by this standard. Where additional risks are present, it is recommended that EN 292-1 and EN 292-2 together with the A and B standards are used as a basis for dealing with these additional risks.

**NOTE 2:** The manufacturer assumes that operators are properly trained and instructed in the intended use of the machine and in the functioning of any safeguarding.

The tables 5.2 to 5.8 specify the preventative measures required for the different types of machinery and plant during consideration of the significant hazards and risks involved in their operation either:

Column 4: by reference to EN 292

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and/or

Column 5: by reference to preventative measure

Unless otherwise stated, the preventative measures assigned to the identified hazardous situations shall be provided in a cumulative manner.