



# SLOVENSKI STANDARD

## SIST EN 1247:2004

01-november-2004

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**Livarski stroji – Varnostne zahteve za livne ponve, opremo za vlivanje, stroje za centrifugalno vlivanje ter stroje za kontinuirno in polkontinuirno vlivanje**

Foundry machinery - Safety requirements for ladles, pouring equipment, centrifugal casting machines, continuous and semi continuous casting machines

Gießereimaschinen - Sicherheitsanforderungen für Pfannen, Gießeinrichtungen, Schleudergießmaschinen kontinuierliche und halbkontinuierliche Stranggießmaschinen

Machines de fonderie - Prescriptions de sécurité concernant les poches, les matériels de coulée, les machines à couler par centrifugation, les machines à couler en continu ou en semi-continu

**Ta slovenski standard je istoveten z: EN 1247:2004**

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ICS 25.120.30

English version

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continuous casting machines

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halbkontinuierliche Stranggießmaschinen

This European Standard was approved by CEN on 17 December 2003.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
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Management Centre: rue de Stassart, 36 B-1050 Brussels

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## Foreword

This document (EN 1247:2004) has been prepared by Technical Committee CEN/TC 202 “Safety requirements of 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of an identical text or by endorsement, at the latest by February 2005, and conflicting national standards shall be withdrawn at the latest by February 2005.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

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

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## Introduction

This document is a type C standard as stated in EN 1070.

The machinery concerned and the extent to which hazards, hazardous situations and 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 type 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.

This document covers: the equipment concerned, the hazards and hazardous situation as well as all events during construction, operation and maintenance normally foreseeable.

## 1 Scope

This document specifies requirements to be met by the manufacturer for the foreseeable significant hazards due to design, construction and installation, during commissioning, operation, maintenance, and decommissioning of the following machines and equipment which are used directly and indirectly for the manufacture of castings:

- Ladles;
- Pouring equipment;
- Centrifugal casting machines for production of tubes (only machines with horizontal or oblique axis of rotation);
- Continuous and semi continuous casting machines for non-ferrous metals.

This document specifies the safety requirements in addressing the following items:

- controls;
- protection against:
  - mechanical hazards, movement of machines and material, ejection of parts, material, liquids and gases, implosion, structural instability;
  - electric hazards;
  - explosion, fire, scalds, contact with hot parts (burns), gases and flames;
  - noise and vibration;
  - thermal radiation;
  - harmful by-products, poisoning, pollution of operators air;
  - impact;
  - deterioration of worker's health;
  - shearing;
  - crushing;

- maintenance, provision for warning systems.

It is assumed that

- normal operation of equipment falling within this scope may involve the intervention of personnel;
- machines are operated by skilled and adequately trained persons;
- machines are used with adequate workplace lighting conforming to local regulations, or to EN 12464-1.

This document does not specify the safety requirements for machines in combination and for ancillary plant, melting, holding, drying and/or heating equipment, crane installations, winches, conveyors or handling systems which could be an integral part of the above equipment, or ladles which are specific to steelworks or ladles forming part of a crane or ladles for pouring by a casting machine or vessels used for molten metal transport on public highway, or continuous or semi continuous casting equipment which is specific to steelworks, or ladles which are carried by hand.

## 2 Normative references

The following referenced documents are indispensable for the application 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.

EN 349:1993, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body.*

EN 418:1992, *Safety of machinery — Emergency stop equipment functional aspects — Principles for design.*

EN 626-1:1994, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machinery manufacturers.*

EN 626-2:1996, *Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 2: Methodology leading to verification procedures.*

EN 746-2:1997, *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems.*

EN 953:1997, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards.*

EN 954-1:1996, *Safety of machinery — Safety related parts of control systems — Part 1: General principles for design.*

EN 1037:1995, *Safety of machinery — Prevention of unexpected start-up.*

EN 1070:1998, *Safety of machinery — Terminology.*

EN 1088:1995, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection.*

EN 1265:1999, *Noise test codes for foundry machines and equipment.*

EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:1997).*

EN 60519-1:1993, *Safety in electroheat installations; Part 1: General requirements (IEC 60519-1:1984).*

EN 61310-1:1995, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, auditory and tactile signals (IEC 61310-1:1995).*

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EN 61310-2:1995, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking (IEC 61310-2:1995).*

EN ISO 4871:1996, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996).*

EN ISO 11688-1/AC:1998, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995).*

EN ISO 12100-1:2003, *Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology (ISO 12100-1:2003).*

EN ISO 12100-2:2003, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications (ISO 12100-2:2003).*

EN ISO 14122-1:2001, *Safety of machinery — Permanent means of access to machinery — Part 1: Choice of a fixed means of access between two levels (ISO 14122-1:2001).*

EN ISO 14122-2:2001, *Safety of machinery — Permanent means of access to machinery — Part 2: Working platforms and walkways (ISO 14122-2:2001).*

EN ISO 14122-3:2001, *Safety of machinery — Permanent means of access to machinery — Part 3: Stairs, stepladders and guard-rails (ISO 14122-3:2001).*

prEN ISO 14122-4:2002, *Safety of Machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO/DIS 14122-4:1996).*

ISO 7745:1989, *Hydraulic fluid power — fire-resistant (FR) fluids — Guidelines for use.*

CENELEC R044-001, 1999, *Safety of machinery — Guidance and recommendations for the avoidance of hazards due to static electricity.*

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### 3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN 1070:1998 and the following apply.

#### 3.1

##### **Ladle**

tiltable vessel with or without hanger with or without refractory lining designed to contain, transport and discharge molten material (see Annex B, Figures B.1 and B.2).

NOTE The tilting movement is often achieved by power driven tilting drives. Sometimes ladles are bottom discharging. In this case discharging is achieved by moving a stopper rod (see Annex B, Figure B.2) or a hydraulically or pneumatically driven bottom slide gate nozzle. Ladles are usually transported by hoists and have their own hanger which is integral to the ladle. Sometimes ladles are transported by floor based trucks or fork lift trucks.

#### 3.2

##### **tundish**

refractory lined vessel with a discharge at its bottom which may be interposed between the ladle and the mould in teeming

#### 3.3

##### **pouring equipment**

mechanically or electrically driven device (see Annex B, Figure B.6) which stores and delivers molten metal to the mould as part of an automatic or semi automatic integrated casting plant

NOTE: This equipment consists of a vessel, heated or unheated, with or without a metering device, for delivery of molten metal to the mould by gravity, or by applying air or inert gas pressure or vacuum onto the surface of the molten metal in the vessel. Heated vessels are also called furnaces.



**3.4****centrifugal casting machine**

machine to manufacture tubes by centrifugal means. The axis of the tube coincides with the axis of rotation and where the thickness of the tube is determined by the dimensions of the mould and the amount of metal cast (see Annex B, Figure B.7). The said axis may be horizontal or oblique (vertical axis of rotation is excluded, see Clause 1)

**3.5****continuous and semi continuous casting machine**

machine which provides a regular or intermittent supply of liquid metal (for this document: non-ferrous metal only, see Clause 1) to a mould, from where the solidified product leaves under gravity or by powered means

Depending upon the direction in which the bar leaves the tundish distinction is made between vertical and horizontal casting. Additionally, distinction is made between continuous and semi continuous casting as to whether the bar is cast without interruption and cut with a flying saw or is stopped after reaching a determined length and is then completely removed from the equipment.

In the non-ferrous metals sector the semi continuous casting process is mainly used.

**3.6****metering**

monitoring the amount of liquid metal

**3.7****breakthrough**

refractory lining of the pouring equipment is penetrated by molten metal

**3.8****stripping/ejection of castings**

removal of the centrifugal casting from the mould after solidification

**3.9****self-locking gear**

a gearbox meets the requirements for self-locking, if the following test gives evidence: the ladle is bottom-placed and removed from the hook; the hanger is moved to a inclined position at approx. 45 degree . The hanger shall be kept in this position by the gearbox. This requirement for self-locking applies for vibration-less conditions only

**3.10****refractories**

material being resistant to high temperatures with a high refractoriness under load for the bricking up and lining of pouring equipment and ladles

**4 List of hazards**

Hazardous situations are those where the risk of being injured through hazardous movements (e. g., squeeze or shear points) or sources of hazard exists (e. g., hazardous materials, conduction and radiation of heat, ejection of molten or very hot metal, explosion, ignition of hydraulic or lubrication fluids, unexpected discharge of molten metal).

A parameter for the level of safety measures to be applied is the risk of accident to be expected, the extent of which depends upon the highest foreseeable degree of severity and effect as well as the probability of an injury, e. g., exposure to risk (frequency of intervention or access or duration of stay in a danger zone). Movable safeguards or facilities with guarding functions in danger zones with fixed cycle intervention or access (e. g., during filling with molten metal or periodical manual cleaning or trouble shooting) require a special degree of safety against unexpected start up or dangerous movements, as well as against hazardous sources and failure of relevant safeguards and control systems.

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

This assessment formed the basis for determining

- a) potentially hazardous situations having significant risks;
- b) the safety requirements and/or measures which shall be incorporated into the machinery/equipment;
- c) any information describing the intended uses which shall be communicated to the user.

The significant hazards and hazardous situations identified are listed in columns 1 and 2 of Clause 5, Table 1.

Before using this document it is important to carry out a risk assessment of the machine in question to check that the machine has the same hazards identified in Clause 5. For hazards not covered by this document the principles contained in EN ISO 12100-1 and EN ISO 12100-2 shall be applied.

## **5 Safety requirements and/or measures**

### **5.1 General**

**5.1.1** Machines conforming to this document shall comply with the safety requirements and/or measures set out in this Clause together with those set out in Clause 7. Relevant hazards identified in the risk assessment carried out by the manufacturer but not dealt with in this document shall be reduced by applying the principles of EN ISO 12100-2.

For hazards which are to be reduced by the application of a B document such as, e. g., EN 294, EN 418, EN 563/A1/AC the risk assessment carried out by the manufacturer shall establish the requirements of the B standard which are to be applied. This specific risk assessment shall be part of the general risk assessment of the machine.

**5.1.2** Where the means of reducing the risk is by the physical arrangement or positioning of the installed machines, the manufacturer shall include in the Information for use a reference to the reduction means to be provided, and to any limiting value of the requirement, and, if appropriate, to the means of verification.

**5.1.3** Where the means of reducing the risk is by a safe system of working, the manufacturer shall include in the Information for use details of the system and of the elements of information required by the operating personnel. This shall include arrangements to run a machine for essential operating reasons or in special mode with safety devices suspended or temporarily modified.

**5.1.4** It is recognised that a general hazard exists of exposure to high temperature surfaces which may be touched and which is not practicable to eliminate. The manufacturers information for use shall contain guidance to the user on the preventative measures to be used in connection with contact to hot surfaces and the need to provide the operator(s) with PPE as appropriate.

**5.1.5** Access to a danger zone is required for any reason during normal operation, e. g., commissioning, setting up, production, maintenance, decommissioning (see 5.2.3 of EN ISO 12100-2:2003). The safety related control system of the machines and equipment shall be in accordance with the appropriate category given in EN 954-1, at least category 3, except for hydraulic equipment which shall be at least category 1.

If access to machines and equipment specified in this document is required for repairs, the measures outlined in 5.5.4 of EN ISO 12100-2:2003, shall apply, where all movements shall be made safe.

**5.1.6** Required guards and enclosures shall be made in such a way that injuries caused by metal eruptions are prevented.

**5.1.7** Table 1 is a comprehensive presentation of significant hazards, the safety requirements to reduce risks, and the means of verifying their presence:

- Column 1 identifies the significant hazards;
- Column 2 identifies the situations that give rise to the hazards;
- Column 3 identifies the risk reduction measures to be applied for the significant hazards and hazardous situations. They shall be provided in a cumulative manner if not otherwise stated;

NOTE When implementing safety requirements and/or measures it has to be considered that different hazards may appear at the same time.

— Column 4 identifies the method to be used to demonstrate conformity; the abbreviations V, F, M and D are defined as follows:

**V:** Visual inspection verifies the required features of the components.

**F:** A functional check/test verifies that the features provided perform their function in such a way that the requirement is met. If a functional check is necessary, the manufacturer shall give details in the instruction handbook (see 7.3).

**M:** Measurement verifies that requirements are met, to the specified limits.

**D:** Drawings and/or calculations verify that the design characteristics of the components provided meet the requirements.

Verification may involve more than one method.

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Table 1 — Safety requirements and/or measures

| Column 1             | Column 2  | Column 3   | Column 4            |
|----------------------|---|--|---------------------|
| Hazard               | Hazardous situation   | Safety measures according to the mentioned standards AND/OR specific measures  | Verifi-cation       |
| <b>5.2 Ladles</b>    |   |  |                     |
| 5.2.1<br>Fire, burns | — Discharge of molten metal or slag due to unexpected tilting in case of:<br><br>— manual tilting                               | — Locking device for ladles tilted by hand.<br><br>— A self-locking gear shall be installed by the manufacturer which is fitted to the forces under operation such that tilting movements are under the control of the operator at all operations. Tilting test shall be carried out with inclined hanger (see 3.9).           | D, F (see Clause 6) |
|                      | — motorised tilting   | — The tilting movement shall be activated only when energised through a hold-to-run control device, placed where its operator has a full and unrestricted view of the ladle and the receiver vessel/container.   | F                   |
|                      | — centre of gravity above trunnion axis, e. g., by modification of nominal capacity by the user (e. g., use of smaller linings) | The manufacturer shall ensure that the centre of gravity is always below the trunnion axis at all operating conditions. He shall advise the user in the Information for use that<br><br>— any modification shall maintain this condition and<br><br>— the conditions due to gearing and maximum operating load shall be given. | D                   |
|                      | — Loss of self-locking of gear in case of gear ladles that are tilted by hand.  | — Lubricants shall not prevent the self-locking of ladle gears.<br><br>— Information for use shall include advice that the gear function shall be checked before every shift (see 7.3.1).  |                     |