SLOVENSKI STANDARD
SIST EN 1247:2004+A1:2010

01-september-2010

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+A1:2010**

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25.120.30	Livarska oprema	Moulding equipment

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Contents

Foreword

This document (EN 1247:2004+A1:2010) 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of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1, approved by CEN on 2010-05-20.

This document supersedes EN 1247:2004.

The start and finish of text introduced or altered by amendment is indicated in the text by tags ⟦A1⟩ ⟨A1⟧.

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 Directives, see informative Annex ZA, which is an integral part of this document.

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

Introduction

〈A1〉 This European Standard is a type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this European Standard.

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 European Standard assumes, that the equipment is operated and maintained by trained personnel. 〈A1〉

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.

〈A1〉 This document is not applicable to ladles, pouring equipment, centrifugal casting machines and continuous and semi-continuous casting machines which are manufactured before the date of its publication as EN. 〈A1〉

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.

〈A1〉 EN 349, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 626-1, *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, *Safety of machinery — Reduction of risk to health from hazardous substances emitted by machinery — Part 2: Methodology leading to verification procedures*

EN 746-2:2010, *Industrial thermoprocessing equipment — Part 2: Safety requirements for combustion and fuel handling systems*

EN 842, *Safety of machinery — Visual danger signals — General requirements, design and testing*

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

EN 981, *Safety of machinery — System of auditory and visual danger and information signals*

EN 982, *Safety of machinery — Safety requirements for fluid power systems and their components — Hydraulics*

EN 983, *Safety of machinery — Safety requirements for fluid power systems and their components — Pneumatics*

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

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

EN 1265:1999+A1:2008, *Safety of machinery — Noise test code for foundry machines and equipment*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60519-1:2003, *Safety in electroheat installations — Part 1: General requirements (IEC 60519-1:2003)*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 61310-1, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

EN 61310-2, *Safety of machinery — Indication, marking and actuation — Part 2: Requirements for marking (IEC 61310- 2:2007)*

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

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

EN ISO 11688-1, *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 (ISO 12100-2:2003)*

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 13850, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

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

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

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

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

EN ISO 14122-4, *Safety of machinery — Permanent means of access to machinery — Part 4: Fixed ladders (ISO 14122-4:2004)*

ISO 3864-1, *Graphical symbols — Safety colours and safety signs — Part 1: Design principles for safety signs in workplaces and public areas*

ISO 7000, *Graphical symbols for use on equipment — Index and synopsis*

ISO 7745, *Hydraulic fluid power — Fire-resistant (FR) fluids — Guidelines for use*

CLC/TR 50404, *Electrostatics — Code of practice for the avoidance of hazards due to static electricity* ⟨A1⟩

3 Terms and definitions

⟨A1⟩ For the purposes of this document, the terms and definitions given in EN ISO 12100-1:2003 and the following apply.

NOTE Definitions used in EN and ISO standards referred to in this European Standard are also valid for this European Standard. ⟨A1⟩

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, [A1] Figure B.5 [A1]) 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

[A1]

3.9
dynamically self-locking
a gearbox meets the requirements for dynamically self-locking, if the geared motor drive stops immediately or after a short time after switch-off even if a torque is acting at the output side of the gearbox

NOTE Dynamic automatic locking is only possible at very high transmissions ratios and in low drive speed ranges. [A1]

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

⟦A1⟧

4 List of significant hazards

The significant hazards, hazardous situations and events, as far as they are dealt with in this document, identified by a risk assessment as significant for the machines conforming to this standard and which require action to eliminate or reduce the risk, are listed in Clause 5, Table 1, together with the appropriate safety measures. ⟦A1⟧

5 Safety requirements and/or measures

5.1 General

5.1.1 ⟦A1⟧ Machines conforming to this standard shall comply with the safety requirements and/or protective measures formulated in Table 1 in relation with the different significant hazards. In addition, the machines shall be designed according to the principles of EN ISO 12100-2 for relevant but not significant hazards which are not dealt with by this document.

For application of type B standards such as EN ISO 13857, EN 349, EN 982, EN 983, EN 1037, EN 60204-1, EN ISO 13850, EN ISO 14122-1, EN ISO 14122-2, EN ISO 14122-3, EN ISO 14122-4, the manufacturer shall carry out an adequate risk assessment for the requirements thereof where choice is necessary (as far as the choice is not made in the requirements of this clause). ⟦A1⟧

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 ⟦A1⟧ If access to a danger zone is required for any reason during normal operation, commissioning, setting up, production, maintenance, decommissioning (see 5.2.3 of EN ISO 12100-2:2003), the parts of the control system related to the guarding or safety devices for ensuring safety during access, shall present at least a performance level PL = d while using a category 3 architecture as defined in EN ISO 13849-1:2008, except for hydraulic equipment for which the performance level PL = c while using a category 1 architecture. ⟦A1⟧

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 ⟦A1⟧ The following Table 1 is developed to allow the designer and manufacturer of the equipment to apply a logical approach for checking the design against the list of significant hazards with respect to the equipment covered by this standard.

Table 1 is structured as follows:

— column 1 identifies the significant hazards;

— column 2 describes the hazardous situations;

— column 3 specifies the safety requirements and/or measures to avoid or minimize the 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 should be considered that different hazards may appear at the same time.

— column 4 identifies the verification 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 test/check verifies that the features provided perform their function in such a way that the requirement is met.

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. A1

Table 1 — Significant hazards, hazardous situations, safety requirements and/or measures

Column 1	Column 2	Column 3	Column 4
Significant hazard	**Hazardous situation**	**Safety measures according to the mentioned standards AND/OR specific measures**	**Verification**
5.2 Ladles			
5.2.1 Fire, burns	— Discharge of molten metal or slag due to unexpected tilting in case of:		
	— manual tilting	— A locking device shall be provided for ladles tilted by hand.	D, F
		— A dynamically self-locking gear (see 3.9) shall be installed by the manufacturer which is fitted to the forces under operation.	D, F
	— 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)	— For steel pouring ladles with ancillary lifting facility only: — the manufacturer shall ensure by design that the centre of gravity is always below the trunnion axis at all operating conditions. — the manufacturer shall advise the user in the information for use that any modification shall maintain this condition	V, D
	— Loss of self-locking of gear in case of gear ladles that are tilted by hand.	— For worm gear units only: Lubricants shall not prevent the self-locking of ladle gears.	V, D
		— For all gear units: — information for use shall include advice that the gear function shall be checked before every shift (see 7.4.2) and — to secure dynamically self-locking, the output torque and the braking torque shall be measured at regular intervals (as a general rule every two years) at a test stand and the results shall be documented.	V, D
	— Insufficient connection between		
	— trunnion and ladle (centre band)	— Ladle trunnions shall be inserted concentrically into the centre band and positively fixed by welding with the centre band and the inner surface of the ladle.	V, D

Table 1 *(continued)*

Column 1	Column 2	Column 3	Column 4
Significant hazard	**Hazardous situation**	**Safety measures according to the mentioned standards AND/OR specific measures**	**Verification**
	— vessel and bottom	— Ladle bottoms shall be designed as flat head or (circular) blank if necessary with reinforcing ribs (see Annex B, Figures B.3, and B.4).	V, D
		— Qualified welders and certificated procedures shall be used (see EN 287-1, EN ISO 14731, EN ISO 3834-1).	V, D
	— Breakage of gear parts.	— Ladle gearing shall be designed to withstand the calculated and foreseen dynamic loads during lifting and transportation.	V, D
		— Information for use shall include advice that impacts to the gear shall be prevented (see 7.4.2).	V
	— Breakthrough of the ladle and unexpected discharge of molten metal.	— Information for use shall include advice that the ladle shall only be used after refractory material has been applied in accordance with the refractory manufacturer's instructions.	V
	— Unexpected discharge from a bottom pouring ladle caused by unintended actuation of the stopper rod equipment.	— The stopper rod equipment (see Annex B, Figure B.2) shall be designed to prevent unintended or accidental actuation, e.g., by a mechanical locking device.	D, F
		— Information for use shall include advice about the need to inspect and renew the stopper at necessary intervals.	V, D
5.2.2 Explosion, burns	— Moisture existing in the lining of the ladle.	— Vents shall be provided for certain types of linings.	V, D
		— Information for use shall include a note that the lining shall be heated and the moisture shall be removed in accordance with the refractory manufacturer's instructions (see 7.4.2).	V, D
	— Bottom pouring ladles	— Information for use should advise the user that pouring zones and ladle filling areas in which bottom pouring ladles are used should have provisions to accommodate molten metal leakage (e. g., sand pits, pit moulds).	V, D
5.2.3 Impact, burns	— Unexpected upset of hanger or ladle.	— Ladles shall be provided with devices to prevent ladle turning e.g., by a locking pin or mechanical latch. Such a device shall only be unlocked immediate before pouring.	V, D