SLOVENSKI STANDARD
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Centrifuge - Splošne varnostne zahteve

Centrifuges - Common safety requirements

Zentrifugen - Allgemeine Sicherheitsanforderungen

Centrifugeuses - Prescriptions communes de sécurité

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Centrifuges - Common safety requirements

Centrifugeuses - Prescriptions communes de sécurité

Zentrifugen - Allgemeine Sicherheitsanforderungen

This European Standard was approved by CEN on 30 August 2014.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Foreword

This document (EN 12547:2014) has been prepared by Technical Committee CEN/TC 313 “Centrifuges - Safety requirements”, the secretariat of which is held by SIS.

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of an identical text or by endorsement, at the latest by April 2015 and conflicting national standards shall be withdrawn at the latest by April 2015.

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 supersedes EN 12547:1999+A1:2009.

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.

The major changes are as follows:

The references in the standard have been updated, thermal hazards have been included, text regarding integrity of the safety related parts of the control system has been further elaborated, the order of the annexes has been changed and the list of hazards has been moved to the main body of the standard.

Annex B of this European Standard is normative, whereas Annex A, Annex C, Annex D and Annex ZA are informative.

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, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

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

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

The extent to which significant hazards are covered is indicated in Clause 1. It is indicated in greater detail in Clause 4.

Manufacturers are required to collect, retain and make available sufficient information, to enable centrifuges to be installed, commissioned, used, maintained and disposed of safely, i.e. that information is made available to users of centrifuges.

Different applications and particular centrifuge designs exist. Annex A includes more details of both of these ranges.

1 Scope

1.1 This European Standard applies to centrifuges for the separation or change in concentration of mixtures of liquids and solids.

It gives requirements to minimize the risks caused by the significant hazards arising during the operation of centrifuges as specified in 1.2.

1.2 This European Standard gives requirements for minimizing the risks caused by the following hazards:

— mechanical hazards common to all types of centrifuges, except those specified in 1.3;

— ergonomical hazards;

— thermal hazards;

— electrical hazards;

— noise.

1.3 Types of centrifuges and hazards excluded

1.3.1 Types of centrifuges excluded:

— centrifuges with a kinetic energy of rotation less than 200 J;

— centrifuges for household use;

— centrifuges for laboratory use according to EN 61010-2-020;

— centrifuges for forming, i.e. centrifugal hot metal casting machines.

1.3.2 Hazards excluded

This European Standard does not deal explicitly with the hazards listed below.

NOTE 1 In cases, where such hazards might occur and could become relevant for the construction of the centrifuge, use specific standards for this hazard or make a risk assessment.

— hazards caused by overpressure or negative pressure inside the centrifuge housing;

— hazards specific to processing radioactive products;

— hazards specific to microbiological processing - including viral and parasitic hazards;

— hazards from processing corrosive and/or erosive materials;

— hazards from processes involving flammable or explosive substances;

— hazards caused by leakage of hazardous substances;

— hazards caused by unsuitable hygienic design for applications involving food products;

— inherent chemical hazards of process materials and/or service media and their biological effects on exposed persons;

NOTE 2 Inherently hazardous substances include toxic, carcinogenic and flammable substances for example. Other substances may be hazardous because of their condition in the centrifuge, i.e. temperature, velocity and vapour pressure.

— hazards due to construction materials;

Materials used in the construction of centrifuges should not be hazardous in the condition in which they are used.

— centrifuges subject to application specific standards (e.g. EN 12505).

NOTE 3 The design of centrifuges covered by EN 12547 varies to the extent that additional hazards may exist that are not covered by the requirements of this standard and is not excluded above. The manufacturer is responsible for providing suitable measures to deal with these hazards as part of a general risk assessment for the machine. Such measures are outside the scope of this standard and the direct responsibility of the manufacturer.

1.3.3 This European Standard gives guidance on the selection of performance levels according to EN ISO 13849-1:2008, but does not identify performance levels for specific applications.

1.4 This European Standard is not applicable to centrifuges which are manufactured before the date of its publication as EN.

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.

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

EN 894-2:1997+A1:2008, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3:2000+A1:2008, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 953:1997+A1:2009, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 1005-2:2003+A1:2008, *Safety of machinery — Human physical performance — Part 2: Manual handling of machinery and component parts of machinery*

EN 1037:1995+A1:2008, *Safety of machinery — Prevention of unexpected start-up*

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

EN 60529:1991, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

EN 61000-6-2, *Electromagnetic compatibility (EMC) — Part 6-2: Generic standards — Immunity for industrial environments (IEC 61000-6-2)*

EN 61000-6-4, *Electromagnetic compatibility (EMC) — Part 6-4: Generic standards — Emission standard for industrial environments (IEC 61000-6-4)*

EN 61310-1:2008, *Safety of machinery — Indication, marking and actuation — Part 1: Requirements for visual, acoustic and tactile signals (IEC 61310-1:2007)*

EN 62061, *Safety of machinery — Functional safety of safety-related electrical, electronic and programmable electronic control systems (IEC 62061)*

EN ISO 780, *Packaging — Pictorial marking for handling of goods (ISO 780)*

EN ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards (ISO 3740)*

EN ISO 3834-2:2005, *Quality requirements for fusion welding of metallic materials — Part 2: Comprehensive quality requirements (ISO 3834-2:2005)*

EN ISO 3834-3:2005, *Quality requirements for fusion welding of metallic materials — Part 3: Standard quality requirements (ISO 3834-3:2005)*

EN ISO 4871:2009, *Acoustics — Declaration and verification of noise emission values of machinery and equipment (ISO 4871:1996)*

EN ISO 5817:2014, *Welding — Fusion-welded joints in steel, nickel, titanium and their alloys (beam welding excluded) — Quality levels for imperfections (ISO 5817:2014)*

EN ISO 9614-1:2009, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: Measurement at discrete points (ISO 9614-1:1993)*

EN ISO 9614-2:1996, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 2: Measurement by scanning (ISO 9614-2:1996)*

EN ISO 9614-3:2009, *Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 3: Precision method for measurement by scanning (ISO 9614-3:2002)*

EN ISO 11688-1:2009, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 1: Planning (ISO/TR 11688-1:1995)*

EN ISO 11688-2:2000, *Acoustics — Recommended practice for the design of low-noise machinery and equipment — Part 2: Introduction to the physics of low-noise design (ISO/TR 11688-2:1998)*

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

EN ISO 13732-1:2008, *Ergonomics of the thermal environment — Methods for the assessment of human responses to contact with surfaces — Part 1: Hot surfaces (ISO 13732-1:2006)*

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 13850:2008, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

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

EN ISO 14119:2013, *Safety of machinery — Interlocking devices associated with guards — Principles for design and selection (ISO 14119:2013)*

3 Terms and definitions

For the purposes of this document, the terms and definition given in EN ISO 12100:2010 and the following apply. Further definitions, giving the preferred terminology for all major parts of centrifuges and being a non-exhaustive list of types of centrifuges, not necessary for the understanding of this standard, are given in Annex A.

3.1 General terms

3.1.1
centrifuge
separation device with a chamber that – when in operation – rotates around its symmetry axis and thus subjects the process material to a centrifugal force

3.1.2
particular centrifuge design
family of centrifuges which may have minor variations in the basic dimensions or speed, but with basically similar specifications and properties of materials of construction

3.1.3
relevant hazard
hazard which is identified as being present at, or associated with, the machine

[SOURCE: EN ISO 12100:2010, 3.7]

Note 1 to entry: A relevant hazard is identified as the result of one step of the process described in EN ISO 12100:2010, Clause 5.

3.1.4
significant hazard
hazard which has been identified as relevant and which requires specific action by the designer to eliminate or to reduce the risk according to the risk assessment

[SOURCE: EN ISO 12100:2010, 3.8]

3.2 Parts of a centrifuge

3.2.1
drum
chamber which holds the process material, and is arranged to rotate about its symmetrical axis

3.2.2
hoop
ring secured to the outer periphery of a drum to give extra strength

3.2.3
basket
drum used for filtration purposes

3.2.4
bowl
drum used for the separation of immiscible liquids and/or the sedimentation of solids

3.2.5
rotor
assembled part of the centrifuge which rotates, comprising drum and shaft together with their attachments

3.2.6
casing
housing
enclosure in which at least the drum rotates and which may constrain process materials and the separated phases leaving the drum to particular paths

Note 1 to entry: The casing may consist of several components.

3.2.7
casing cover
lid
part fixed to the casing to provide access, for example for inspection, operation or maintenance

3.2.8
discharge device
device to induce discharge of liquids and/or solids from the centrifuge rotor

Note 1 to entry: A discharge device can for example be a paring tube which discharges a liquid from a rotating rotor by dipping a fixed tube into the liquid.

3.2.9
scraper
plough
peeler
device for the removal of centrifuged solids from the rotating drum

3.2.10
critical component
part of a centrifuge that cause significant hazardous situations to develop when it fails or ruptures

3.2.11
special lifting accessory
device tailored to the lifting and other handling requirements of a centrifuge or specific component of the centrifuge

3.3 Operational terms

3.3.1
process material
substances fed to a centrifuge for separation and other purposes, for example washing, purging or drying the load

3.3.2
filling mass
total mass of process material in the drum at any instant

3.3.3
maximum filling mass
filling mass determined by the limiting features of the centrifuge, for example either drum strength or linear dimensions

3.3.4
cleaning in place
CIP
cleaning of equipment by impingement or circulation of flowing chemical solutions and water rinses into, onto and over surfaces in equipment or systems without dismantling, using equipment designed and installed for that purpose

3.3.5
kinetic energy of total rotating system
total kinetic energy of the rotor together with the filling mass at operating speed

3.3.6
maximum temperature
maximum allowable temperature of the process material declared by the manufacturer

3.3.7
minimum temperature
minimum allowable temperature of the process material declared by the manufacturer

3.3.8
normal operation
operating condition of the centrifuge, determined by specification and design, considering feed and wash rates, load, vibration, rotational speeds, etc.

Note 1 to entry: Normal operation includes start up and shut-down procedures.

3.3.9
operating speed
<centrifuge> rotational speed measured in revolutions per unit time at which the rotor revolves either at constant speed during continuous operation or intermittently with different rotational speeds when operating in several steps during a multispeed programme

3.3.10
purging
removal of unwanted material from a centrifuge by means of a flushing media

3.3.11
throughput
⟨centrifuge with continuous process material flow⟩ actual feed rate

3.3.12
throughput
⟨centrifuge using a batch or non-continuous process⟩ charge mass per cycle and cycle time

3.3.13
out of balance
unbalance
unequal distribution of filling mass and/or rotor mass which produces oscillating forces during rotation

3.3.14
service media
liquids, gases etc. used for operating the centrifuge

3.3.15
critical speed
characteristic speed or rotating frequency of the centrifuge at which resonance of the centrifuge system is excited

3.3.16
run down time
period between the time at which the stop command is initiated and the time at which the rotor has stopped completely

3.3.17
maximum run down time
run down time that is required by the centrifuge after having been switched off or e.g. after an electrical power outage to come to a complete standstill without any deceleration device

3.3.18
dangerous run down time
run down time which is longer than the time needed for a skilled person to remove a guard and to reach dangerous moving parts of the machine

4 List of significant hazards

Table 1 is a list of significant hazards associated with the use of a centrifuge. The table is the result of a risk assessment carried out in accordance with EN ISO 12100:2010, Clause 5, for all centrifuges covered by the scope of this standard.

The technical measures in Clause 5 and information for use in Clause 7 are based on that risk assessment, and deal with the identified hazards by either eliminating them or reducing the effects of the risks they generate.

The designer should determine which of the hazards in Table 1 are applicable to their centrifuge design, paying particular attention to the intended use of the centrifuge including maintenance and cleaning, and of its reasonably foreseeable misuse. The designer should also consider other hazards related to the design of the centrifuge.

Table 1 — List of significant hazards

Hazards (see EN ISO 12100:2010, Annex B**)**	**Clause/subclause in this European Standard**
Hazards, hazardous situations and hazardous events	
Mechanical hazards	
Ejection of parts	5.2.1
Ejection of high kinetic energy process material or service media	5.2.2
Dangerous movement	5.2.3
Access to moving parts	5.2.6
Electrical hazards due to:	
Contact of persons with live parts (direct contact)	5.3
Contact of persons with parts which have become live under faulty conditions (indirect contact)	5.3
Noise hazards	
Noise	5.7, Annex B
Ergonomic hazards	
Unhealthy postures or excessive effort	5.2.4, 5.2.5, 5.4
Design, location or identification of control devices	5.4
Thermal hazards	5.5
Unexpected start-up, unexpected overrun/overspeed (or any similar malfunction)	
Restoration of energy supply after an interruption	5.6