SLOVENSKI STANDARD
SIST EN 1248:2002

01-januar-2002

Foundry machinery - Safety requirements for abrasive blasting equipment

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Gießereimaschinen - Sicherheitsanforderungen für Strahlanlagen

Machines de fonderie - Prescriptions de sécurité pour équipements de grenaillage

Ta slovenski standard je istoveten z: **EN 1248:2001**

ICS:

25.120.30 Livarska oprema Moulding equipment

SIST EN 1248:2002 **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 1248

April 2001

ICS 25.120.30

English version

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

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Ref. No. EN 1248:2001 E

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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of an identical text or by endorsement, at the latest by October 2001, and conflicting national standards shall be withdrawn at the latest by October 2001.

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

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

An assessment of the foreseeable risks arising from the use of the equipment was carried out when this standard was drafted by CEN/TC 202/WG 4, comprising experts from the following countries: France, Germany, Italy, Sweden and United Kingdom.

Annex A is normative, and Annex B is 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, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

INTRODUCTION

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

The equipment and hazards covered by this standard are shown in the scope. In addition, abrasive blasting machinery shall comply, as appropriate with EN 292-1 and EN 292-2 for hazards which are not covered by this standard.

1 SCOPE

This standard specifies requirements to be met by the manufacturer of abrasive blasting equipment for the foreseeable significant hazards due to design, construction and installation, during commissioning, operation, maintenance and decommissioning of the equipment which employ either centrifugal force or compressed air as a means of accelerating abrasive to achieve the desired result.

Abrasive blasting equipment covers:

- centrifugal blasting machines;
- air blasting machines;
- loading, conveying and unloading systems for the workpieces.

See Annex A for more details.

This standard covers all foreseeable significant hazards which could be encountered during the lifetime of the machine as listed in clause 5.

This standard does not apply to:

- mobile centrifugal blasting equipment;
- mobile air blasting equipment;
- wet blasting equipment;
- the general works compressed air supply system.

2 NORMATIVE REFERENCES

This Standard incorporates by dated or undated references 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 (including amendments).

EN 271	Respiratory protective devices - Compressed air line or powered fresh air hose breathing apparatus incorporating a hood for use in abrasive blasting operations
EN 286-1	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+ A1:1995	Safety of machinery - Basic concepts, general principles for design - Part 2: Technical principles and specifications
EN 294	Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs
EN 349	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
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 775+AC:1993	Manipulating Industrial robots – safety (ISO 10218:1992, modified)
EN 953	Safety of machinery – General requirements for the design and construction of guards (fixed, moveable)
EN 954-1:1996	Safety of machinery - Safety related parts of control systems Part 1: General principles for design
EN 982	Safety of machinery - Safety requirements for fluid power systems and their components - hydraulics
EN 999	Safety of machinery – The positioning of protective equipment in respect of approach speeds of parts of the human body

EN 1037	Safety of machinery - Prevention of unexpected start-up
EN 1070	Safety of machinery - Terminology
EN 1088:1995	Safety of machinery - Interlocking devices associated with guards – Principles for design and selection
EN 1265	Noise test code 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 60529	Degrees of protection provided by enclosures (IP-Code); (IEC 60529:1989)
prEN 620:1992	Continuous handling equipment and systems – Fixed belt conveyors for bulk material – Special safety requirements for design, manufacturing, erection and commissioning stages
prEN 1005-3:1993	Safety of machinery - Human physical performance Part 3: Recommended force limits for machinery operation
EN ISO 11124-1	Preparation of steel substrates before application of paints and related products - Specifications for metallic blast-cleaning abrasives - Part 1: General introduction and classification (ISO 11124-1:1993)
EN ISO 11126-1	Preparation of steel substrates before application of paints and related products - Specifications for non-metallic blast-cleaning abrasives - Part 1: General introduction and classification (ISO 11126-1:1993, including Technical Corrigenda 1:1997 and 2:1997)
EN ISO 11688-1	Acoustics - Recommended practice for the design of low-noise machinery and equipment Part 1: Planning (ISO/TR 11688-1:1995)
CENELEC R044-001, February 1999	Safety of machinery – Guidance and recommendations for the avoidance of hazards due to static electricity

3 TERMS AND DEFINITIONS

For the purposes of this standard, the terms and definitions given in EN 1070 apply.

Other terms and definitions are as follows:

3.1
blasting
process where workpiece to be cleaned or surface to be treated is subjected to continuous attack by abrasive blasting media to achieve the desired result

3.2
blasting equipment
machines employing either centrifugal force or compressed air as a means of accelerating abrasive.

The equipment comprises a chamber which contains the workpiece and also prevents the abrasive media from escaping to the environment after impacting on the workpiece.
It also incorporates: a system for collecting, recycling, cleaning by air or magnetic separation or a combination of both and storage for the abrasive media ready to feed back to the dosing device for abrasive media (for examples of blasting equipment types see Annex A, for an example of a processing scheme see Annex B, Figure B.1) and a conveying system for workpieces.

3.3
abrasive media

granular metallic or non-metallic material to be forcibly applied to a surface to achieve the desired result

Classification of metallic abrasives see EN ISO 11124-1, of non-metallic abrasives see EN ISO 11126-1.

3.4
free-jet work
a manual blasting process carried out with hand held nozzles where protective separation between the operator and the rebounding abrasive media and generated dust. The operator shall wear an abrasive blasting helmet and other protective clothing.

3.5
exhaust system
extraction device which collects contaminated air under a slight negative pressure and transports it via appropriate ducting to a dust collector

3.6
dust separator
air cleaning device to remove contaminated particulates prior to discharge to the atmosphere

3.7
explosion relief panel
device to release pressure safely and rapidly

3.8
transfer car
vehicle used for transporting the workpieces into and out of the blasting chamber

NOTE The vehicle is often on rails.

3.9
machine setting
control of the actuation of a mechanism during setting phases when the machine is manually controlled; guards having been by-passed

3.10
manual operation
any sequence or event which is manually controlled by the operator

3.11
automatic operation
every cycle initiates the next cycle automatically whereby all supplementary steps are carried out by a predetermined program

4 HAZARDS

Abrasive blasting equipment shall be designed to take into consideration the hazards, the safety requirements and the preventative measures referred to in clause 5.

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, 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 standard was prepared. When additional risks are present it is recommended that EN 292-1 and EN 292-2 together with the relevant A and B standards are used as a basis for dealing with these additional risks.

This assessment formed the basis for determining

a) The safety features which shall be incorporated into the equipment;

b) Any special instructions which shall be communicated to the user.

The hazards and hazardous situations are tabulated in clause 5 (table 1) together with the appropriate safety measures.

5 SAFETY REQUIREMENTS AND/OR MEASURES

5.1 General

The preventative measures assigned in table 1 to the identified hazardous situations shall be provided by the manufacturer.

In addition, equipment shall comply, as appropriate, with the standards given in clause 2.

Where access is gained through guards/doors into a working area the safety related parts of the electro-mechanical/electronic control system shall be in accordance with category 3 of EN 954-1:1996. The hydraulic and pneumatic systems shall be in accordance with category 1 of EN 954-1:1996.

Emergency stop equipment shall be in accordance with EN 418 (where applicable, for determination of categories see table 1).

Where it is possible to gain access to a hazardous area which is not protected by a movable guard or door, access shall be prevented by fixed guards in accordance with EN 294, EN 953 and EN 1088.

When selecting the adequate solution the manufacturer shall apply the following principles in the given order:

1) Elimination or minimisation of risks by integration of the safety concept into the design of the machine.
2) Establishment of adequate safety measures against remaining risks (e.g. guard scaffolding, light barriers)
3) Instruction to personnel concerning the remaining risks (e.g. service manuals, danger signs).

When more than one measure is necessary to safeguard a hazard then all the necessary measures shall be used. When selecting the safety requirements and/or measures consideration shall be given to the different hazards that may appear at the same time. Warning signs alone are not sufficient in cases of significant risk.

The last column of table 1 indicates the means of verification of the safety requirements and/or measures. The abbreviations **V**, **P**, **M** and **D** are defined as follows:

V: Visual inspection is used to verify the features necessary for the requirement by visual examination of the components supplied.

P: Performance check/test verifies that the features provided perform their function in such a way that the requirement is met.
If a performance check is necessary details shall be given by the manufacturer 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.

Table 1 - Safety requirements and/or measures

Hazard	Hazardous Situation	Safety measures according to the mentioned standards AND/OR specific measures	Verifi-cation
5.2 Centrifugal wheel assembly (see Annex B, figures B.2 and B.3)			
5.2.1 Shearing and crushing. Cutting and severing	Access to shear traps between fixed and internal rotating parts from either a hooded wheel or accessible through a door when the wheel is running up or down.	3.22.5 of EN 292-1:1991 and interlocking guard with guard locking according EN 953 and EN 1088, connected with stop category 1 according 4.1.5 of EN 418:1992.	V, D
5.2.2 Impact by ejection of parts	Exposure to thrown off abrasive media/workpiece or projectile.	3.22.5 of EN 292-1:1991 and EN 953, e.g. withstand the impact of propelled abrasive media as well as an escaping wheel blade whilst the wheel is running.	V
5.2.3 Cutting, severing crushing	Access to pneumatic/ hydraulic actuated moving parts of the abrasive media feed valve, e.g. in case of trouble-shooting (clogging within pipes) and during maintenance.	3.22.1 of EN 292-1:1991 (Fixed guard) 3.8 of EN 292-2:1991 Ensure possibility of depressurising when isolating the machine.	V
5.3 Blasting chamber			
5.3.1 Blasting chamber of centrifugal blasting machines			
5.3.1.1 Crushing, shearing, cutting, impact	Access to the blasting chamber with doors. Movement of the wheels and/or wheel blades escaping whilst the wheel is running.	3.22.5 of EN 292-1:1991 and 5.4.1 of EN 1088:1995 connected with stop category 1 according 4.1.5 of EN 418:1992. An interlocking guard with guard locking shall be fitted to prevent the wheel starting unless the blasting chamber doors are closed and to prevent the doors being opened until the wheels have come to a complete stop.	V,D

(continued)

Table 1 (continued)

Hazard	Hazardous Situation	Safety measures according to the mentioned standards AND/OR specific measures	Verifi-cation
		It shall not be possible to open the door(s) until the abrasive media flow had been shut off. Either a) the wheels shall have come to a complete stop; or b) the wheel hood covers shall be in closed position. The start up of the wheels or the opening movement of the wheel hood covers shall only be possible after the doors are closed 3.7 of EN 292-2:1991 and EN 1037 (Design control system to prevent un-expected start-up/restart).	V
5.3.1.2 Impact, abrasive media attack	Ejection of blasting abrasive media at entry and exit points of machines.	Clause 3 of EN 292-2:1991 (Risk reduction by design). The abrasive material shall be prevented from escaping from the blasting chamber e.g. by the use of labyrinth of curtains, compressed air (see Annex B, figure B.4). It is not possible to give precise details of the preventative measures because of the nature of the abrasive media and the size/shape of the workpiece to be blasted. 5.4c of EN 292-2:1991 (Manufacturer shall specify the use of eye protection), see 7.3.1.	V

(continued)