



# SLOVENSKI STANDARD

## SIST EN 12957:2002+A1:2009

01-maj-2009

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### Obdelovalni stroji - Varnost - Stroji EDM

Machine tools - Safety - Electro discharge machines

Werkzeugmaschinen - Sicherheit - Funkenerodiermaschinen

Machine-outils - Sécurité - Machines d'électroérosion

Ta slovenski standard je istoveten z: EN 12957:2001+A1:2009

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#### **ICS:**

25.120.40	Elektrokemijski stroji	Electrochemical machines
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EUROPEAN STANDARD  
NORME EUROPÉENNE  
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English Version

**Machine tools - Safety - Electro discharge machines**

Machine-outils - Sécurité - Machines d'électroérosion

Werkzeugmaschinen - Sicherheit -  
Funkenerodiermaschinen

This European Standard was approved by CEN on 9 May 2001 and includes Amendment 1 approved by CEN on 29 December 2008.

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





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

**Management Centre: Avenue Marnix 17, B-1000 Brussels**

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## Foreword

This document (EN 12957:2001+A1:2009) has been prepared by Technical Committee CEN/TC 143 "Machine tools - Safety", the secretariat of which is held by SNV.

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of an identical text or by endorsement, at the latest by August 2009, and conflicting national standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-12-29.

This document supersedes EN 12957:2001.

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

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 EU Directive(s).

A1 Annexes A, ZA and ZB of this standard are informative, Annex B is normative. A1

A1 For relationship with EU Directive(s), see informative Annexes ZA and ZB, which are integral parts of this document. A1

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, 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

This standard applies to equipment using the process of Electro Discharge Machining (EDM) as defined in clause 3. This European Standard 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 standard.

Complementary guidance is given in type A and B Standards to which reference is made in the text.

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. It provides one means of conforming with the Essential Health and Safety Requirements (EHSR's) of the "Machinery Directive" (98/37/EC).

## 1 Scope

**1.1** This standard specifies technical safety requirements and measures, applicable to EDM equipment and EDM system (e.g. for spark erosion-sinking, spark erosion-wire cutting), to be adopted by persons undertaking the design, construction, installation and/or supply of such equipment. This standard also includes information to be provided by the manufacturer to the user.

**1.2** The design requirements of this standard shall not apply to arc eroding and electro chemical machining equipment.

**1.3** This standard takes account of the intended use in normal workshop environment and non explosive atmospheres including installation, setting, maintenance, repair and dismantling for removal or disposal of EDM equipment.

**1.4** This standard also applies to auxiliary devices essential for EDM processing.

**1.5** This standard deals with specific hazards defined in clause 4, Table 1, and the measures of prevention in clause 5, Table 2.

**1.6** This standard applies to machines built after its date of issue.

**NOTE** Directive 94/9/EC concerning equipment and protective systems intended for use in potentially explosive atmospheres can be applicable to the type of machine or equipment covered by this European Standard. The present standard is not intended to provide means of complying with the essential health and safety requirements of Directive 94/9/EC.

## 2 Normative references

This European Standard contains dated or not dated references on 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 2:1992, *Classification of fires*

EN 54-1:1996, *Fire detection and fire alarm systems – Part 1: Introduction*

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 292-2:1991/A1:1995, *Safety of machinery - Basic concepts, general principles for design – Part 2: Technical principles and specifications, (Amendment A.1)*

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 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 775:1992, *Manipulating industrial robots - Safety (ISO 10218:1992 modified)*

EN 811:1996, *Safety of machinery - Safety distances to prevent danger zones being reached by the lower limbs*

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 982:1996, *Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics*

EN 983:1996, *Safety of machinery - Safety requirements for fluid power systems and their components - Pneumatics*

EN 999:1998, *Safety of machinery - The positioning of protective equipment in respect of approach speeds of parts of the human body*

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

EN 1050:1996, *Safety of machinery - Principles for risk assessment*

EN 1070:1998, *Safety of machinery - Terminology*

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

prEN 12437-1:1996, *Safety of machinery - Permanent means of access to machines and industrial plants – Part 1: Choice of a fixed means of access between two levels*

prEN 12437-2:1996, *Safety of machinery - Permanent means of access to machines and industrial plants – Part 2: Working platforms and gangways*

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prEN 12437-3:1996, *Safety of machinery - Permanent means of access to machines and industrial plants – Part 3: Stairways, stepladders and guard-rails*

prEN 12437-4:1996, *Safety of machinery - Permanent means of access to machines and industrial plants – Part 4: Fixed ladders*

EN 55011:1998, *Industrial, scientific and medical (ISM) radio frequency equipment - Radio disturbance characteristics - Limits and methods of measurement (CISPR 11:1997, modified)*

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

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

EN 60742:1995, *Isolating transformers and safety isolating transformers - Requirements (IEC 60742:1983 + A1:1992, modified)*

EN 61000-6-2:1999, *Electromagnetic compatibility (EMC) Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2:1999)*

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

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

EN ISO 3746: 1995, *Acoustics – Determination of sound power levels of noise sources using sound pressure - Survey method using an enveloping measurement surface over a reflecting plane (ISO 3746:1995)*

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

EN ISO 11202:1995, *Acoustics - Noise emitted by machinery and equipment - Measurement method of emission sound pressure levels at the workstation and at other specified positions - Survey method in situ*

EN ISO 11688-1:1998, *Acoustics – Recommended practice for the design of low noise machinery and equipment – Part 1: Planning*

### 3 Terms and definitions

For the purposes of this standard, the definitions given in EN 1070:1998 apply together with definitions listed below.

Other general definitions (e.g. hazard, risk, safeguarding) are mentioned in corresponding type A and type B Standards and in the annex A of EN 292-2:1991.

**3.1**  
**arc erosion; arc eroding; arc machining**  
the removal of material by constant (non pulsed) electro discharges, performed in a dielectric medium. The discharges are initiated by periodical contact of the electrode with the work piece interrupted by axial movement of the electrode

**3.2**  
**arc erosion equipment**  
all the necessary units for the process of arc machining

**3.3**



**automatic mode**

use of the machine under numerical control to achieve programmed sequential operation. This term is equivalent with machining mode

**3.4****control circuit**

circuit used for the operational control of the machine and for protection of the power circuits

**3.5****control system for EDM equipment or EDM system**

the system from the initial actuator or sensor to the point of input to the final actuator or element (e.g. motor, cylinders)

**3.6****dielectric fluid (for EDM processes)**

non-conductive medium to improve the discharge effect, evacuate debris and to cool the work piece/electrode

**3.7****dielectric fluid container**

unit and/or systems used to keep the dielectric fluid in a condition suitable for EDM (e.g. filter unit/dielectric system)

**3.8****EDM equipment**

all the necessary units for the process of electro discharge machining which includes the machine tool, the generator, control circuits, the dielectric fluid container and integral devices

**3.9****EDM system**

an assembly of EDM equipment and other machines or devices which are arranged, linked and controlled to function as an integral whole

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**3.10****electro chemical equipment**

all the necessary units for the process of electro chemical machining

**3.11****electro chemical machining; ECM**

any machining process based on electrolysis

**3.12****electro discharge machining; EDM**

any machining process based on spark erosion

**3.13****electromagnetic compatibility; EMC**

the ability of the EDM equipment/system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment

**3.14****flammable dielectric fluid**

dielectric fluid used in EDM, characterised by its relative ease of ignition and relative ability to sustain combustion

**3.15****flash point**

minimum temperature at which, under specified test conditions, a liquid gives off sufficient combustible gas or vapour to ignite momentarily on application of an effective ignition source

**EN 12957:2001+A1:2009 (E)****3.16****generator (for EDM equipment)**

device to convert electrical power supplied to the machine for the purpose of being used for spark erosion processing

**3.17****operator of an EDM equipment and/or system**

person or persons given the task of programming, setting, adjusting, operating, maintaining and cleaning the machinery

**3.18****setting/manual mode**

use of the machine for unprogrammed operations under the control of the operator

**3.19****setting mode (simulation mode)**

use of the machine under numerical control, without machining power, to check/optimize the NC-programme and allowing manual interventions

**3.20****shielding of EDM equipment**

mechanical barrier or enclosure of conductive material intended to attenuate the emission/penetration of a varying electromagnetic field into an assigned region

**3.21****spark erosion; spark eroding; spark machining; EDM process**

removal of material in a dielectric fluid by electro discharges, which are separated in time and randomly distributed in space, between two electrically conductive electrodes (the tool electrode and the work piece electrode), and where the energy in the discharge is controlled

**3.22****spark erosion-sinking**

removal of material by spark erosion to produce various shapes in the work piece e.g. concave, convex and prismatic holes

**3.23****spark erosion-wire cutting**

removal of material by spark erosion with a wire electrode to produce prismatic shapes in the work piece

**3.24****tool changer (for EDM equipment); electrode changing device**

mechanism integrated with the machine to supply a previously loaded electrode in exchange for another electrode. The electrode changing device is expected to enable an operator to load/unload electrodes from outside the work area.

**3.25****work area (on EDM equipment)**

space within the envelope of the machine where the EDM process can take place

**3.26****work piece changing device (for EDM equipment)**

mechanism integrated with the machine to supply a previously loaded work piece in exchange for another work piece. The work piece changing device is designed to enable an operator to load/unload work pieces from outside the work area.

**3.27****work tank (for EDM equipment)**

unit surrounding the work area to contain the dielectric fluid for EDM processes

## 4 List of hazards

The list of hazards contained in Table 1 is the result of a risk assessment, carried out as described by EN 1050:1996 for all EDM equipment covered by the scope of this standard. The technical measures and information for use contained in clause 5 and 7 are based on the risk assessment and deal with the identified hazards by either eliminating them or reducing the effects of the risks they generate.

The significant hazards covered by this standard are listed in Table 1.

Particular attention is given to hazards dealing with:

- Electrical hazards (electrode voltage);
- Flammable dielectric fluid (level, temperature, fire detection);
- Hazardous substances (waste disposal, filters, used dielectric fluid, fume extraction, electrodes and sludges);
- Electromagnetic emissions (radiated and conducted).

**NOTE** The designer's attention is focused on hazards which can occur during the life of the machine to both operator and other persons who have access to the danger zone/s for conditions of intended use including reasonably foreseeable misuse of the machine (see EN 292-1:1991, 3.12) for both spark erosion with automatic mode and operations requiring intervention (e.g. setting, maintenance, repair). Although acoustic noise is not considered to be a significant hazard for EDM equipment, the manufacturer of the equipment is not absolved from reducing noise and making noise declaration. The designer is cautioned to verify whether the list of hazards in Table 1 is exhaustive and applicable and, if there are other hazardous situations, not listed in Table 1, which are related to the specific equipment in question.

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## EN 12957:2001+A1:2009 (E)

Table 1 — List of significant hazards and major sources of these hazards associated with Electro Discharge Machines

*	Description	Hazardous situation action	Activity	Danger zone	Reference to Table 2
<b>1</b>	<b>Mechanical hazards</b> due to:				
1d	Mass and velocity (kinetic energy of elements in controlled or uncontrolled motion)	movements of machine elements	setting, machining and maintenance	at and near the machine	A3 - A5
1.1 + 1.2	Crushing and shearing	work piece clamping	loading/unloading, reorienting	between clamps and work piece	A1, A2, A3
		automatic work piece/electrode changing	power operated, work piece/ electrode change	envelope of work piece/electrode motion	A1, A2, A3
		moving parts (e.g. axes, rolling elements)	manual operation/work piece/electrode change	between work piece/electrode and machine parts	A1, A2, A3
1.4	Entanglement	manual or automatic work piece/electrode changing, spindle rotation and wire rollers	manual or power operated work piece/electrode changing and spindle rotation	between work piece/electrode and machine parts	A1, A2, A3
1.9	High pressure fluid injection or ejection	hydraulic/pneumatic systems ejection, leakage and flushing	setting, machining and maintenance	at and near the machine	A4

(continued)

Table 1 (continued)

*	Description	Hazardous situation action	Activity	Danger zone	Reference to Table 2
<b>2</b>	<b>Electrical hazards</b> due to:				
2.1	Contact of persons with live parts (direct contact)	contact with work piece/electrode, wire/wire-path and contact with unprotected circuits	process control, setting and maintenance	work piece, electrode, tooling fixture, generator and electrical enclosure	B1, B2
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	contact with parts of the machine which are not live during normal operation	maintenance and service of the machine	at and near the machine, insulation of electrical cables and equipment	B1, B3
<b>7</b>	<b>Hazards generated by materials and substances</b> (and their constituent elements) processed or used by the machinery				
7.1	Contact with or inhalation of harmful fluids, gases, mists, fumes, and dust	conditions near the machine caused by ejection of dielectric fluid, droplets or evaporation, mists, fumes, etc.	during the EDM process, setting, maintenance and disposal of the machine	at and near the machine	D1 - D5
7.2	Fire or explosion	fire hazard originated by flammable mist generation, long lasting arcing condition, loss of dielectric fluid, fault of electrical or hydraulic power supply, etc.	during the EDM process	near the machine and the work tank	D5 - D12
<b>10</b>	<b>Unexpected start-up, unexpected overrun/overspeed</b> (or any similar malfunction) from:				
10.2	Restoration of the energy supply after an interruption	malfunction of the machine itself and/or electrical/pneumatic equipment due to restoration of the energy supply	after energy restoration	at the machine	E3
10.3	External influences on electrical equipment	malfunction of the machine itself or electrical equipment due to electromagnetic disturbances	machine in operation, setting and maintenance	at and in the vicinity of the machine	C1
13	Failure of the power supply	malfunction resulting from power loss, powered clamping failures and machine elements moving under residual forces (e.g. inertia, gravity)	all activities at the machine	at all moving elements of the machine	E1, E2

(continued)