SLOVENSKI STANDARD
SIST EN 1037:1999+A1:2008

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Varnost strojev - Prepreļevanje nepriļakovanega zagona

Safety of machinery - Prevention of unexpected start-up

Sicherheit von Maschinen - Vermeidung von unerwartetem Anlauf

Sécurité des machines - Prévention de la mise en marche intempestive

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Safety of machinery - Prevention of unexpected start-up

Sécurité des machines - Prévention de la mise en marche intempestive

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Foreword

This document (EN 1037:1995+A1:2008) has been prepared by Technical Committee CEN/TC 114 “Safety of 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of an identical text or by endorsement, at the latest by October 2008, and conflicting national standards shall be withdrawn at the latest by October 2008.

This document supersedes EN 1037:1995.

This document includes Amendment 1, approved by CEN on 2008-03-18.

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).

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

The drafting was carried out by a working group of CEN/TC 114 (WG 9) with participation of experts from CENELEC/TC 44 X.

This standard is a type B1 standard in accordance with EN 414.

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 the United Kingdom.

Introduction

Keeping a machine in a stopped condition while persons are present in danger zones is one of the most important conditions of the safe use of machinery and hence one of the major aims of the machine designer and machine user.

In the past, the concepts of "operating machine" and "stopped machine" were generally unambiguous; a machine was:

— Operating when its movable elements, or some of them, were moving;

— Stopped when its movable elements were at rest.

Machine automation has made the relationship between "operating" and "moving" on the one hand, "stopped" and "at rest" on the other hand, more difficult to define. Automation has also increased the potential for unexpected start-up, and there are a significant number of accidents where machines, stopped for diagnostic work or corrective actions, started up unexpectedly.

Hazards other than mechanical hazards generated by movable elements (e.g. from a laser beam) also need to be taken into account.

The risk assessment relating to the presence of persons in a danger zone of a stopped machine needs to take into account the probability of an unexpected start-up of the hazard-generating machine elements.

This standard provides machine designers and technical committees in charge of preparing machinery safety standards with a survey of built-in measures intended to prevent unexpected start-up.

1 Scope

This standard specifies built-in safety measures aimed at preventing unexpected machine start-up (see 3.2) to allow safe human interventions in danger zones (see Annex A).

This standard applies to unexpected start-up from all types of energy source, i.e.:

— Power supply, e.g. electrical, hydraulic, pneumatic;

— Stored energy due to, e.g., gravity, compressed springs;

— External influences, e.g. from wind;

2 Normative references

This European Standard incorporates, by dated or undated reference, 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.

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.*

prEN 1050[1)], *Safety of machinery – Principles for risk assessment.*

ENV 1070, *Safety of machinery – Terminology.*

EN 60204-1:1992, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements.*

3 Definitions

For the purposes of this standard, the definitions given in ENV 1070 "Safety of machinery – Terminology" apply, together with the following:

3.1
start-up (machine start-up)
change from rest to motion of a machine or of one of its parts

NOTE The definition includes functions other than motion, e.g. switch-on of a laser beam

3.2
unexpected [unintended] start-up
any start-up caused by:

— a start command which is the result of a failure in, or an external influence on, the control system;

— a start command generated by inopportune action on a start control or other parts of the machine, as e.g. a sensor or a power control element;

— restoration of the power supply after an interruption;

— external/internal influences (gravity, wind, self-ignition in internal combustion engines…) on parts of the machine;

NOTE Automatic machine start-up during normal operation is not unintended, but can be considered to be unexpected from the point of view of the operator. Prevention of accidents in this case involves the use of safeguarding measures (see clause 4 of EN 292-2:1991)

3.3
isolation and energy dissipation
a procedure which consists of all the four following actions:

a) isolating [disconnecting, separating] the machine (or defined parts of the machine) from all power supplies;

b) if necessary (for instance in large machines or in installations), locking (or otherwise securing) all the isolating units in the isolating position;

c) dissipating or restraining [containing] any stored energy which may give rise to a hazard.

NOTE Energy may be stored in e.g.:

— Mechanical parts continuing to move through inertia;

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1) Draft standard prepared by CEN/TC 114/WG 14

— Mechanical parts liable to move by gravity;

— Capacitators, accumulators;

— Pressurized fluids;

— Springs.

d) Verifying by means of a safe working procedure that the actions taken according to a), b) and c) above have produced the desired effect.

4 General

4.1 Isolation and energy dissipation

Machines shall be provided with devices intended for isolation and energy dissipation (see clause 5), especially with a view to major maintenance, work on power circuits and decommissioning (see the essential safety requirement expressed in 1.6.3 of annex A of EN 292-2:1991).

4.2 Other means to prevent unexpected [unintended] start-up

If the use of isolation and energy dissipation is not appropriate (e.g. for frequent short interventions in danger zones), the designer shall provide, according to the risk assessment (see prEN 1050), other measures (see clause 6) to prevent unexpected start-up. Additional means such as signalling and/or warning may be appropriate (see annex B).

NOTE 1 Examples of tasks which can require the presence of persons in danger zones are given in annex A

NOTE 2 According to 5.7.1 of EN 292-1:1991, the designer should as completely as possible determine the different machine operating modes and the need for the presence of persons in danger zones. Appropriate built-in safety measures can then be provided to prevent operators from being induced to use hazardous operating modes and hazardous intervention techniques caused by technical difficulties in the use of the machine (see also 3.12 "Intended use of a machine" of EN 292-1:1991).

5 Devices for isolation and energy dissipation

5.1 Devices for isolation from power supplies

5.1.1 Isolation devices shall:

— Ensure a reliable isolation (disconnection, separation);

— Have a reliable mechanical link between the manual control and the isolating element(s);

— Be equipped with clear and unambiguous identification of the state of the isolation device which corresponds to each position of its manual control (actuator).

NOTE 1 For electrical equipment, a supply disconnecting device complying with 5.3 "Supply disconnecting (isolating) device" of EN 60204-1:1992 meets this requirement.

NOTE 2 Plug and socket systems (for electrical supplies), or their pneumatic, hydraulic or mechanical equivalents, are examples of isolating devices with which it is possible to achieve a visible and reliable discontinuity in the power supply circuits. For electrical plug/socket combinations, see 5.3.2 d) of EN 60204-1:1992.

NOTE 3 For hydraulic and pneumatic equipment, see also 5.1.6 of prEN 982 and 5.1.6 of prEN 983.

5.1.2 The location and number of isolation devices are determined by the configuration of the machine, the need for the presence of persons in danger zones and the risk assessment. Each isolation device shall make it possible (e.g. by durable marking where necessary) to readily identify which machine or machine part it isolates.

NOTE For electrical equipment of machinery, see also 5.4 "Devices for switching off for prevention of unexpected start-up" of EN 60204-1:1992.

5.1.3 When, during isolation of the machine, certain circuits have to remain connected to their power supply in order, e.g. to hold parts, save information or provide local lighting, special means shall be provided to ensure operator safety.

NOTE Such means include enclosures which can be opened only with a key or a special tool, warning labels and/or warning lights

5.2 Locking [securing] devices

The isolating devices shall be capable of being locked or otherwise secured in the isolating position.

NOTE 1 Locking devices may not be necessary when a plug/socket combination is used and the plug can be kept under immediate supervision of the person present in the danger zone

NOTE 2 Locking devices include:

— Facilities to apply one or more padlocks;

— Trapped-key interlocking devices (see annex E of prEN 1088), one of the locks of which is used to lock [secure] the isolating device;

— Lockable covers or enclosures.

Locking devices are not required when reconnection cannot endanger persons.

5.3 Devices for stored energy dissipation or restraint [containment]

5.3.1 General

5.3.1.1 Devices for stored energy dissipation or restraint [containment] shall be incorporated into the machine where stored energy can give rise to a hazard.

NOTE Such devices include, e.g., brakes intended to absorb kinetic energy of moving parts, resistors and relevant circuitry to discharge electrical capacitators, valves or similar devices to depressurize fluid accumulators (see 5.1.6 of prEN 982 and 5.1.6 of prEN 983).

5.3.1.2 When dissipation of stored energy would excessively reduce the availability of the machine, additional devices shall be incorporated to reliably restrain or contain the remaining stored energy.

5.3.1.3 The devices for energy dissipation or restraint [containment] should be selected and arranged so that:

— Dissipation or restraint [containment] results from the isolation of the machine (of part of it) from the power supplies;

— The energy dissipation process does not give rise to hazardous situations.

5.3.1.4 The necessary procedures for energy dissipation or restraint [containment] shall be described in the instruction handbook of the machine or in warnings on the machine itself.

5.3.2 Mechanical elements

When mechanical elements can give rise to a hazardous situation

— By virtue of their weight and position (e.g. unbalanced, or raised, or in any situation where they could move under the effect of gravity), or

— As a result of the action upon them of spring load (whatever the spring may be),

it shall be possible to bring them to the lowest energy state (e.g. lowest position or spring relaxed) either by the usual machine manual controls or by devices specifically designed and identified (marked) for that function.

When mechanical elements cannot be brought to an intrinsically safe state, they shall be mechanically secured by brakes or mechanical restraint devices (see 3.23.6 of EN 292-1:1991).

5.3.3 Locking or securing facilities for the restraint [containment] devices

The devices for energy restraint [containment] shall whenever necessary be capable of being locked or otherwise secured in the restraining position.

5.4 Verification

5.4.1 General

The machine and the isolation and energy dissipation devices shall be designed, selected and arranged so that reliable verification of the effectiveness of the isolation and energy dissipation can be carried out.

Provisions to verify the effectiveness of the isolation and energy dissipation measures shall not impair their effectiveness.

5.4.2 Provisions for verifying isolation

Isolation from any power supply shall either be visible (visible interruption of the power supply circuits) or indicated by an unambiguous position of the manual control [actuator] of the isolating device.

NOTE See also 5.1.1 as regards the mechanical link between each isolating element and the associated manual control

5.4.3 Provisions for verifying energy dissipation or restraint [containment]

5.4.3.1 Built-in devices (such as pressure gauges) or test points shall be provided for verifying the absence of energy in parts of a machine in/on which interventions are intended.

5.4.3.2 The instruction handbook (see 5.5 of EN 292-2:1991) shall provide precise guidance on safe verification procedures.

5.4.3.3 Permanent labels warning against hazards due to stored energy shall be fixed to assemblies which contain hazardous stored energy (e.g. compressed springs) and can be removed or dismantled.

6 Measures – other than isolation and energy dissipation – intended to prevent unexpected start-up

6.1 Design strategy

In all cases where isolation and energy dissipation are not appropriate for all interventions, the designer shall decide, according to the risk assessment, the measures (amongst those listed below) he considers necessary to prevent unexpected start-up:

— Measures (such as component design, selection and location) designed to prevent accidental generation of start commands from external or internal influences in any part of the machine (see 6.2);

— Measures, dependent on the system architecture/structure, designed to prevent accidental start commands resulting in an unexpected start-up (see 6.3);

— Measures designed to automatically stop the hazard-generating part of the machine before a hazardous situation can arise from an unexpected start-up of this part (see 6.4).

The selected measures shall not be considered as possible substitutes for the measures for isolation and energy dissipation specified in clause 5.

NOTE The selected measures will in most cases be a combination of different measures described in this clause

6.2 Measures intended to prevent accidental generation of start commands

6.2.1 Measures intended to prevent accidental actuation of (manual) start controls [actuators]

Accidental actuation of (manual) start controls, as well as unexpected results from actuating these devices (e.g. start-up of another machine or initiation of a movement in a wrong direction), shall be prevented by appropriate design, location, protection and marking of (manual) start controls. In all cases where disparity between the expected effect of (manual) start controls and their actual effect can endanger persons, accurate information shall be given, e.g. by marking (see also the first paragraph of annex B).

NOTE 1 Guidance is given in 3.7.8 "Principles relating to manual control" of EN 292-2:1991 and in EN 61310 "Safety of machinery – Indication, marking and actuation principles".

NOTE 2 Other examples of measures to prevent unauthorised/unintended start-up are locking of start manual controls, passwords in programmable control systems.

6.2.2 Design of the safety-related parts of the data storage and processing equipment

The safety-related parts of the data storage and processing equipment (see figure 1) shall be designed, and their components selected, so that the probability of this equipment generating start commands which may lead to an unexpected start-up can be considered sufficiently low when this probability is taken into account in the risk assessment carried out in accordance with prEN 1050.

NOTE 1 Guidance is given in:

— 3.7 "Applying safety principles when designing control systems" of EN 292-2:1991;

— EN 60204-1:1992, especially clause 9 "Control circuits and control functions" and clause 12 "Electronic equipment".