SLOVENSKI STANDARD
SIST EN 1088:2000

01-junij-2000

Varnost strojev - Zaporne naprave, povezane z varovali - Naļ ela za naļ rtovanje in izbiro

Safety of machinery - Interlocking devices associated with guards - Principles for design and selection

Sicherheit von Maschinen - Verriegelungseinrichtungen in Verbindung mit trennenden Schutzeinrichtungen - Leitsätze für Gestaltung und Auswahl

Sécurité des machines - Dispositifs de verrouillage associés a des protecteurs - Principes de conception et de choix

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13.110	Varnost strojev	Safety of machinery

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English version

Safety of machinery - Interlocking devices associated with guards - Principles for design and selection

Sécurité des machines - Dispositifs de verrouillage associés à des protecteurs - Principes de conception et de choix

Sicherheit von Maschinen - Verriegelungseinrichtungen in Verbindung mit trennenden Schutzeinrichtungen - Leitsätze für Gestaltung und Auswahl

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CEN

European Committee for Standardization
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Foreword

This European Standard has been prepared by CEN/TC 114 "Safety of machinery", of which the secretariat is held by DIN.

The drafting was carried out by a working group (WG 10) of CEN/TC 114.

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of an identical text or by endorsement, at the latest by June 1996, and conflicting national standards shall be withdrawn at the latest by June 1996.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association. It supports essential requirements of the EU Machinery Directive, notably those expressed in the following articles of Annex A of EN 292--2:1991/A1:1995 : 1.3.7 "Prevention of risks related to moving parts"; 1.3.8 "Choice of protection means against risks related to moving parts"; 1.4 "Required characteristics of guards and protection devices".

This standard is a type B2 standard in accordance with EN 414.

According to the CEN/CENELEC Internal Regulations, the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

0 Introduction

This standard has been prepared to be a harmonized standard to provide one means of conforming with the essential safety requirements of the Machinery Directive and associated EFTA Regulations.

Its primary purpose is to give guidance to machinery designers and writers of type C standards on how to design or to select interlocking devices associated with guards with a view to complying with the relevant essential safety requirements of the EC Machinery Directive (see Foreword). It may also be used as guidance in controlling the risk where there is no type C standard for a particular machine.

Relevant sections of this standard, used alone or in conjunction with provisions from other standards, can be used as a basis for verification procedures for the suitability of a device for interlocking duties.

A statement by a manufacturer that an interlocking device complies with EN 1088, without reference to specific clauses, has no meaning.

The annexes A,B..., P are informative. Annexes A to N contain only examples complying with the principles set out in this standard, and the application of which has been validated by experience. Other solutions may be adopted, provided that they comply with the same principles. Annex P is entitled "Bibliography".

1 Scope

This standard specifies principles for the design and selection – independent of the nature of the energy source – of interlocking devices associated with guards (as defined in 3.23.1 "interlocking device [interlock]", 3.22.4 "interlocking guard" and 3.22.5 "interlocking guard with guard locking" of EN 292-1:1991).

It also provides requirements specifically intended for electrical interlocking devices (see clause 6).

This standard covers the parts of guards which actuate interlocking devices. Requirements for guards are given in prEN 953. The processing of the signal from the interlocking device to stop and immobilize the machine is dealt with in prEN 954-1.

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
EN 294:1992	Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs
prEN 953	Safety of machinery - General requirements for the design and construction of guards (fixed, movable)
prEN 954-1	Safety of machinery - Safety-related parts of control systems - Part 1 : General principles for design
prEN 999	Safety of machinery - The positioning of protective equipment in respect of approach speed of parts of the human body
prEN 1037	Safety of machinery - Prevention of unexpected start-up
prEN 1050	Safety of machinery - Principles for risk assessment
EN 60204-1:1992	Safety of machinery - Electrical equipment of machines - Part 1 : General requirements
EN 60947-5-1:1991	Low-voltage switchgear and controlgear - Part 5 : Control circuit devices and switching elements - Section 1 : Electromechanical control circuit devices (IEC 947-5-1:1990)

3 Definitions

For the purposes of this standard the following definitions apply :

3.1 interlocking device [interlock]

Mechanical, electrical or other type of device, the purpose of which is to prevent the operation of machine elements under specified conditions (generally as long as a guard is not closed).

[3.23.1 of EN 292-1:1991]

3.2 interlocking guard

Guard associated with an interlocking device, so that :

- the hazardous machine functions "covered" by the guard cannot operate until the guard is closed ;

- if the guard is opened while the hazardous machine functions are operating, a stop instruction is given ;

- when the guard is closed, the hazardous machine functions "covered" by the guard can operate, but the closure of the guard does not by itself initiate their operation.

[3.22.4 of EN 292-1:1991]

NOTE : In English "stop signal" and "stop command" are synonyms for "stop instruction". In German "Stop-Signal" and "Stop-Befehl" are synonyms for "Halt-Befehl". In French "ordre d'arrêt" is an all-encompassing term.

3.3 interlocking guard with guard locking

Guard associated with an interlocking device and a guard locking device so that :

- the hazardous machine functions "covered" by the guard cannot operate until the guard is closed and locked ;

- the guard remains closed and locked until the risk of injury from the hazardous machine functions has passed ;

- when the guard is closed and locked, the hazardous machine functions "covered" by the guard can operate, but the closure and locking of the guard do not by themselves initiate their operation.

[3.22.5 of EN 292-1:1991]

3.4 guard locking device

Device intended to lock a guard in the closed position and linked to the control system so that :

- the machine cannot operate until the guard is closed and locked ;
- the guard remains locked until the risk has passed.

3.5 automatic monitoring

A back-up safety function which ensures that a safety measure is initiated if the ability of a component or an element to perform its function is diminished, or if the process conditions are changed in such a way that hazards are generated.

There are two categories of automatic monitoring :

- "continuous" automatic monitoring, whereby a safety measure is immediately initiated when a failure occurs ;
- "discontinuous" automatic monitoring, whereby a safety measure is initiated during a following machine cycle, if a failure has occurred.

[3.14 of EN 292-1:1991]

3.6 positive mode actuation

If a moving mechanical component inevitably moves another component along with it, either by direct contact or via rigid elements, the second component is said to be actuated in the positive mode (or positively) by the first one.

[based on 3.5 of EN 292-2:1991]

3.7 positive opening operation of a contact element

The achievement of contact separation as the direct result of a specified movement of the switch actuator through non-resilient members (e.g. not dependent upon springs).

[2.2 of chapter 3 "Special requirements for control switches with positive opening operation" of EN 60947-5-1:1991].

NOTE : For fluid power, the equivalent concept may be called "positive mode interruption".

3.8 stopping time [time for hazard elimination]

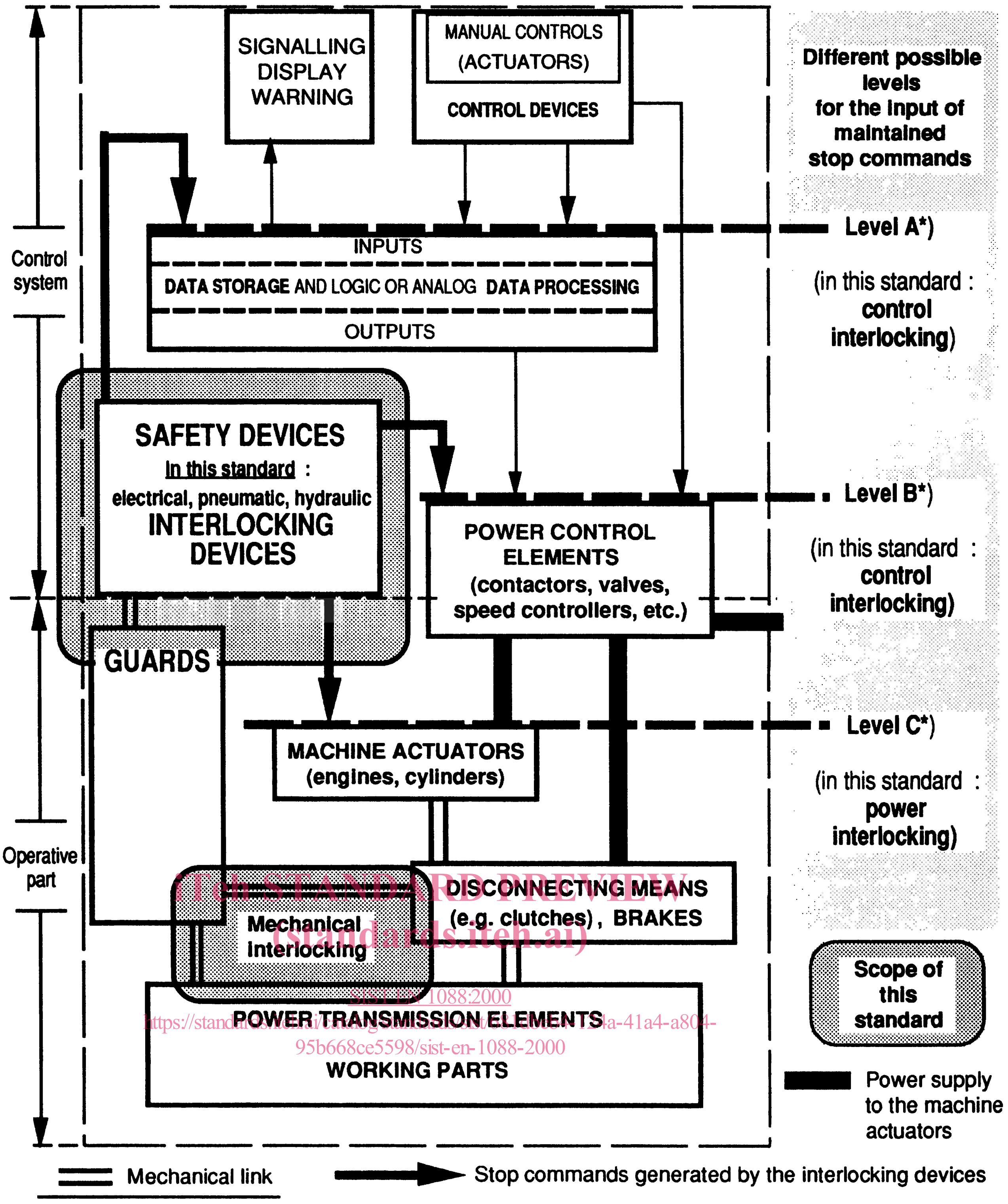
The period between the point at which the interlocking device initiates the stop command and the point at which the risk from hazardous machine functions has passed.

3.9 access time [time for access to a danger zone]

The time taken to access the hazardous machine parts after initiation of the stop command by the interlocking device, as calculated on the basis of an approach speed the value of which may be chosen, for each particular case, taking into account the parameters given in prEN 999 "Safety of machinery – The positioning of protective equipment in respect of approach speeds of parts of the human body".

4 Operating principles and typical forms of interlocking devices associated with guards

NOTE : Reference is made to the relevant informative annexes where it is considered useful for clearer understanding.



*) in accordance with prEN 1037

Figure 1 : Location of interlocking devices in machinery
[based on Annex A of EN 292-1]

4.1 Interlocking principles

4.1.1 Control interlocking

The stop command from the interlocking device is introduced into the control system so that interruption of the energy supply to the machine actuators – or mechanical disconnection of moving parts from the machine actuators – is triggered by the control system (indirect interruption : levels A and B in figure 1).

4.1.2 Power interlocking

The stop command from the interlocking device directly interrupts the energy supply to the machine actuators or disconnects moving parts from the machine actuators (level C in figure 1). "Directly" means that, unlike control interlocking (see 4.1.1), the control system does not play any intermediate role in the interlocking function.

4.2 Typical forms of interlocking devices

4.2.1 Interlocking device (without guard locking) (see table 1 and figure 3a))

It is always possible to open the guard. As soon as the guard is no longer closed, the interlocking device generates a stop command. As it is possible to start opening the guard during operation of the machine (or of the hazardous machine elements), the function is that of an interlocking device, as defined in 3.22.4 of EN 292-1:1991.

Examples of interlocking devices without guard locking are shown in annexes A, B, F, G, J, K, L.

4.2.2 Interlocking device with guard locking (see table 1 and figure 3b))

The guard is held closed by a guard locking device (see 3.4). There are two types of devices :

- those where unlocking the guard can be initiated at any time by the operator (unconditional unlocking : see table 1 and figure 3b1)) ;
- those where unlocking the guard is possible only if a condition is fulfilled, thus ensuring that the hazard has disappeared (conditional unlocking : see table 1 and figure 3b2)).

The guard locking device (see 3.4) can be an integral part of an interlocking device, or a separate unit.

In a guard locking device, the part which is intended to lock/unlock the guard can be :

- manually applied, manually released (see figure N.1 in annex N) ;

- spring applied, power released (see figure 2a)) ;

- power applied, spring released (see figure 2b)) ;
- power applied, power released (see figure 2c)).

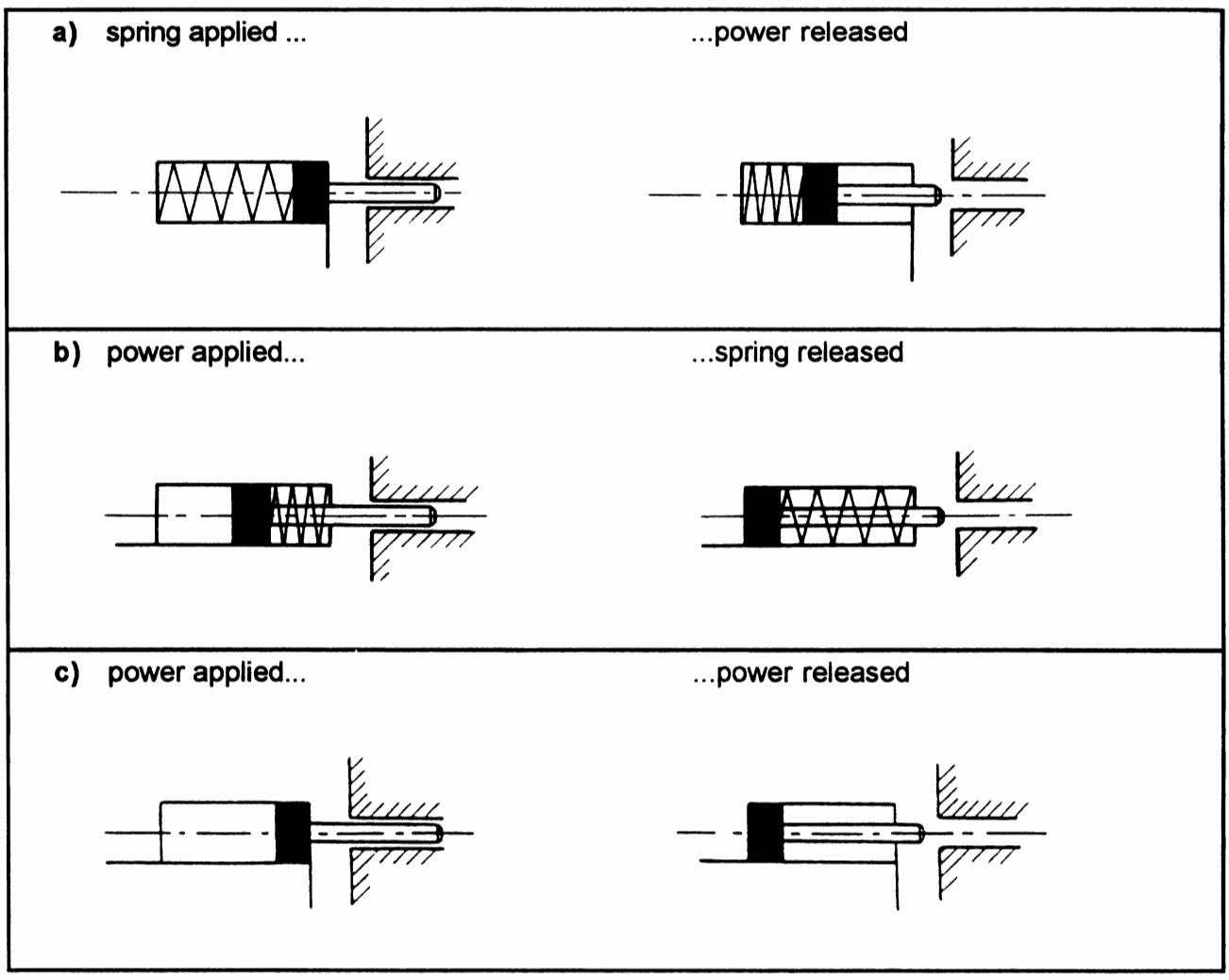


Figure 2 : Operating modes of the guard locking device in power-actuated guard locking devices

Examples of interlocking devices with guard locking are given in annexes C, D , E, H, M, N.