



**SLOVENSKI STANDARD**  
**SIST EN 982:1998+A1:2008**

**01-november-2008**

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**Varnost strojev - Varnostne zahteve za fluidne sisteme in njihove komponente - Hidravlika**

Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics

Sicherheit von Maschinen - Sicherheitstechnische Anforderungen an fluidtechnische Anlagen und deren Bauteile - Hydraulik

Sécurité des machines - Prescriptions de sécurité relatives aux systèmes de transmissions hydrauliques et pneumatiques et à leurs composants - Hydraulique

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**Ta slovenski standard je istoveten z: EN 982:1996+A1:2008**

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**ICS:**

23.100.01      Fluid power systems in general

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**en**

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 982:1996+A1**

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ICS 23.100.01

Supersedes EN 982:1996

English Version

## Safety of machinery - Safety requirements for fluid power systems and their components - Hydraulics

Sécurité des machines - Prescriptions de sécurité relative  
aux systèmes et leurs composants de transmissions  
hydrauliques et pneumatiques - Hydraulique

Sicherheit von Maschinen - Sicherheitstechnische  
Anforderungen an fluidtechnische Anlagen und deren  
Bauteile - Hydraulik

This European Standard was approved by CEN on 11 March 1996 and includes Amendment 1 approved by CEN on 27 July 2008.

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This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

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

Management Centre: rue de Stassart, 36 B-1050 Brussels

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## Foreword

This document (EN 982:1996+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 March 2009, and conflicting standards shall be withdrawn at the latest by December 2009.

This document includes Amendment 1, approved by CEN on 2008-07-27.

This document supersedes EN 982:1996.

The start and finish of text introduced or altered by amendment is indicated in the text by tags  $\square_{A1}$   $\square_{A1}$ .

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).

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

It was developed to contribute towards unification of safety regulations and procedures in the various member countries for each aspect dealt within the field of hydraulics for fluid power systems and their components. This Standard utilizes the most recently validated technical information from established technical sources (e.g. CEN, ISO, national standards and European documents).

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 is a type B2 standard (according to EN 292-1) and contains the general requirements for hydraulic systems and their components on machinery. For type C standard makers, it is a basis for the development of specific requirements on dedicated machines. If no type C standards are available, it is a basis for the manufacturers when constructing machines that include hydraulic systems and their components.

In developing this standard, safety related requirements out of ISO 4413 were selected as well as additional safety related requirements.

Equivalent safety requirements for pneumatic systems are defined in EN 983 "Safety of machinery – Safety requirements for fluid power systems and their components – Pneumatics".

## 1 Scope

This standard applies to hydraulic systems and their components on machinery. It identifies hazards and factors which affect the safety of systems and their components when they are put to their intended use.

The principles specified apply to the design, construction and modification of new systems and their components and aspects of use including:

- Assembly
- Installation
- Adjustment
- Operation
- Cleaning
- Maintenance.

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Components are covered in the standard but only to the extent that safety requirements are given to allow the components to be safely integrated into a system's design.

The standard applies to systems and their components on machinery that are manufactured after the date of the adoption of this standard.

## 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 418, *Safety of machinery – Emergency stop equipment, functional aspects – Principles for design.*

EN 563, *Safety of machinery – Temperature of touchable surfaces – Ergonomic data to establish temperature limit values for hot surfaces.*

prEN 954-1:1992, *Safety of machinery - Safety related parts of control systems — Part 1: General principles for design.*

prEN 1050:1992, *Safety of machinery - Risk assessment*

ENV 1070, *Safety of machinery – Terminology.*

prEN 1127-1:1993, *Safety of machinery – Fire and explosions – Part 1: Explosion prevention and protection.*

EN 50081-2, *Electromagnetic compatibility – Generic emission standard – Part 2: Industrial environment.*

prEN 50082-2:1994, *Electromagnetic compatibility – Generic immunity standard – Part 2: Industrial environment.*

EN 60204-1:1992, *Safety of machinery - Electrical equipment of machines – Part 1: General requirements (IEC 204-1:1992, modified).*

EN 60529, *Degrees of protection provided by enclosures (IP code) (IEC 529:1989).*

ISO 1219-1, *Fluid power systems and components – Graphic symbols and circuit diagrams – Part 1: Graphic symbols.*

ISO/DIS 1219-2:1993, *Fluid power systems and components – Graphic symbols and circuit diagrams – Part 2: Circuit diagrams.*

ISO 4021, *Hydraulic fluid power – Particulate contamination analysis – Extraction of fluid samples from lines of an operating system.*

ISO 5598, *Fluid power systems and components - Vocabulary.*

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

### 3 Definitions

For the purposes of this standard, the definitions of ENV 1070 and the following apply. Other definitions not included are given in ISO 5598.

#### 3.1

##### **fluid power**

the means whereby signals and energy can be transmitted, controlled and distributed using a pressurized fluid as the medium

#### 3.2

##### **system**

arrangement of interconnected components which transmits and controls fluid power energy

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- 3.3 component**  
an individual unit (e.g. cylinder, motor, valve, filter) comprising one or more parts designed to be a functional part of a fluid power system
- 3.4 hydraulics**  
science and technology which deals with the use of a liquid as the fluid power medium
- 3.5 maximum working pressure**  
the highest pressure at which the system or part of the system is intended to operate in steady-state conditions
- 3.6 rated pressure**  
the highest pressure at which the component is intended to operate for a number of repetitions sufficient to assure adequate service life
- 3.7 operating device**  
device that provides an input signal to a control mechanism (e.g. cam, switch)
- 3.8 control mechanism**  
a device that provides an input signal to a component (e.g. lever, solenoid)
- 3.9 actuator**  
component that transforms fluid energy into mechanical energy (e.g. motor, cylinder)
- 3.10 piping**  
any combination of fittings, couplings or connectors with pipes, hoses or tubes which allows fluid flow between components

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**4 List of hazards**

The possible hazards associated with the use hydraulic power in a machine are given in table 1:



Table 1 — List of hazards

Hazard type	Relevant clauses			Relevant type B standard or clause in this standard
	EN 292-1:1991	EN 292-2:1991	Annex A of EN 292-2:1991	
4.1 Mechanical hazards <ul style="list-style-type: none"> <li>— shape</li> <li>— relative location</li> <li>— mass and stability (potential energy of elements)</li> <li>— mass and velocity (kinetic energy of elements)</li> <li>— inadequacy of the mechanical strength</li> <li>— accumulation of potential energy by:               <ul style="list-style-type: none"> <li>— elastic elements (springs), or</li> <li>— liquids or gases under pressure, or</li> <li>— vacuum</li> </ul> </li> <li>— leakage</li> </ul>	4.2		1.3, 1.4, 1.3.7	5.1.1, 5.1.2, 5.1.3, 5.1.5, 5.1.7, 5.2.1, 5.2.2, 5.2.3, 5.3.1, 5.3.2, 5.3.3, 5.3.4.2, 5.3.4.3, 5.3.4.4, 5.3.4.5, 7.2, 7.3.1
4.2 Electrical hazards				5.1.6, 5.2.1, 5.3.3.3.2 a, EN 60204-1
4.3 Thermal hazards resulting in burns and scalds, by a possible contact of persons, by flames or explosions and also by the radiation of heat sources				5.1.9, 5.1.10, 5.2.1, 5.3.4.6
4.4 Hazards generated by noise				5.1.8, 5.2.1
4.5 Hazards, especially unintended movements, caused by electromagnetic fields		3.7.11	1.5.10, 1.5.11	EN 50081-2, prEN 50082-2
4.6 Hazards generated by materials and substances processed, used and exhausted by machinery			1.5.13	
4.6.1 Hazards resulting from contact with or inhalation of harmful fluids, gases, mists, fumes and dusts				5.3.2.6, 7.1, 7.2
4.6.2 Fire or explosion hazards				5.2.1, 5.3.4.1

continued

Table 1 — (concluded)

Hazard type	Relevant clauses			Relevant type B standard or clause in this standard
	EN 292-1:1991	EN 292-2:1991	Annex A of EN 292-2:1991	
4.7 Hazards caused by failure of energy supply, breaking down of machinery parts and other functional disorders	5.2.2	3	1.2	
4.7.1 Failure of energy supply (of energy and/or control circuits) — variation of energy — unexpected start — prevention from stopping if the command has already been given — falling or ejecting of moving parts or pieces held by the machinery — impeded automatic or manual stopping — protection device remains not fully effective	3.16	3.7	1.2.6	5.1.4, 5.1.6, 5.2.1, 5.3.3.2 c, 5.3.3.2 d
4.7.2 Unexpected ejection of machine parts or fluids	4.2.1	3.8, 4	1.3.2, 1.3.3	5.2.1, 5.3.4.3.2
4.7.3 Failure, malfunction of control system (unexpected start up, unexpected overrun)	3.15, 3.16, 3.17	3.7	1.2.7, 1.6.3	prEN 954-1, 5.1.4, 5.1.6, 5.3.3.2, 5.3.5, 5.3.6, 5.3.7
4.7.4 Errors of fitting			1.5.4	5.2.1, 5.2.2, 5.2.3, 5.3.3.1, 5.3.4.2, 5.3.4.3, 5.3.4.5.3, 7.3
4.8 Hazards caused by temporarily missing and/or incorrectly positioned safety related measures/means, for example		4		
4.8.1 Starting and stopping devices		3.7	1.2.3, 1.2.4	5.1.4
4.8.2 Safety signs and signals		3.6.7, 5.2, 5.3, 5.4	1.7.2, 1.7.3	5.3.4.5.1, 7.2
4.8.3 All kinds of information or warning devices		5.4	1.7.0, 1.7.1	5.3.4.1.3, 5.3.4.4.2, 5.3.5.7, 7.3
4.8.4 Energy supply disconnecting devices		6.2.2	1.6.3	5.1.6, 5.3.4.5.2, 7.2
4.8.5 Emergency devices		6.1	1.2.4	EN 418
4.8.6 Essential equipment and accessories for safe adjusting and /or maintaining	3.3, 3.11	3.12, 6.2.1, 6.2.3, 6.2.6	1.1.2 f, 1.1.5	5.1.5, 5.3.2.3, 5.3.4.1.3, 5.3.5.1, 5.3.5.2

## 5 Safety requirements and/or measures

When designing hydraulic systems for machinery, all intended operations and use of systems shall be considered. Risk assessment in accordance with prEN 1050 shall be carried out to determine the foreseeable risks associated with systems when they are used as intended by their design. So far as it is practicable, the risks identified shall be eliminated by design and, where this is not practicable, the design shall incorporate safeguards against such risks. See EN 292-2.

Where systems or parts of systems have safety related control functions, they should be designed and constructed to meet specified categories of performance, as given in prEN 954-1.

### 5.1 Basic requirements for the design and specification of hydraulic systems

**5.1.1** All components in the system shall be selected or specified to provide for safety in use, and they shall operate within their design limits when the system is put to its intended use. Components shall be selected or specified so that they have adequate characteristics to allow them to operate reliably under all intended uses of the system. Particular attention shall be paid to the reliability of components that could create a hazard in the event of their failure or malfunction.

The components shall be selected, applied and installed in accordance with the manufacturer's recommendations.

NOTE It is recommended that, wherever practicable, components should be made in conformance with recognised international or national standards.

**5.1.2** All parts of the system shall be designed or otherwise protected against pressures exceeding the maximum working pressure of a system or any part of the system or the rated pressure of any specific component.

The preferred means of protection against excessive pressure are one or more pressure relief valves located to limit the pressure in all parts of the system. Alternative means, such as pressure compensator pump controls, may be used, provided those means satisfy the application requirements.

Systems shall be designed, constructed and adjusted to minimize surge pressures and intensification pressures. Surge pressure and intensified pressure shall not cause hazards.

Loss of pressure or critical drops in pressure shall not expose persons to a hazard.

**5.1.3** Leakage (internal or external) shall not cause a hazard

**5.1.4** Whatever the type of control or power supply used (e.g. electrical, hydraulic, etc.) the following actions or occurrences (unexpected or by intention) shall not create a hazard:

- Switching the supply on or off;
- Supply reduction;
- Supply cut-off or re-establishment.