# SLOVENSKI STANDARD
# SIST EN 1804-1:2002

**01-junij-2002**

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**Stroji za podzemne rudnike - Varnostne zahteve za hidravliļ no podporje - 1. del: Deli podporja in sploģne zahteve**

Machines for underground mines - Safety requirements for hydraulic powered roof supports - Part 1: Support units and general requirements

Maschinen für den Bergbau unter Tage - Sicherheitsanforderungen für hydraulischen Schreitausbau - Teil 1: Ausbaugestelle und allgemeine Anforderungen

Machines pour mines souterraines - Exigences de sécurité relatives aux soutenements marchants applicables aux piles - Partie 1: Unités de soutenement et exigences générales



**Ta slovenski standard je istoveten z: EN 1804-1:2001**

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**ICS:**

| | | |
|---|---|---|
| 73.100.10 | Oprema za gradnjo predorov in podzemnih železnic | Tunnelling and tubbing equipment |

**SIST EN 1804-1:2002** **en**

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

# EN 1804-1

October 2001

ICS 73.100.10

English version

# Machines for underground mines - Safety requirements for hydraulic powered roof supports - Part 1: Support units and general requirements

Machines pour mines souterraines - Exigences de sécurité relatives aux soutènements marchants applicables aux piles - Partie 1: Unités de soutènement et exigences générales

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This European Standard was approved by CEN on 21 September 2001.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.



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 Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.



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

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

## Contents

## Foreword

This European Standard has been prepared by Technical Committee CEN/TC 196 "Machines for underground mining - Safety", the secretariat of which is held by BSI.

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 April 2002, and conflicting national standards shall be withdrawn at the latest by April 2002.

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.

This standard is Part 1 of a European Standard specifying the safety requirements for hydraulic powered roof supports.

Other parts are:

Part 2: Power set legs and rams

Part 3: Hydraulic control systems

Part 4[1]): Electro-hydraulic control systems

Annex A is normative.

This standard includes a Bibliography.

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.



## 0 Introduction

This European Standard is a Type C-standard as stated in EN 1070.

The extent to which hazards are covered is indicated in the scope of the standard.



While producing (or when compiling) this standard it was assumed that:

- only trained and competent persons operate the machine;
- components without specific requirements are:
  - a) designed in accordance with the usual engineering practice and calculation codes;
  - b) of sound mechanical construction;
  - c) free of defects.
- components are kept in good working order;
- a negotiation took place between the user and the manufacturer concerning the use of the machinery.

## 1 Scope

This standard specifies the safety requirements for support units when used as specified by the manufacturer or his authorised representative. Examples of support units are frame supports, chock supports, shield supports, paired frames and push-pull support systems including the components of advancing and anchoring devices which provide support functions. This part of the standard excludes fixing elements on the conveyor, coal-winning equipment, power set legs and rams, valves, hydraulic and electro-hydraulic control units, lighting and signalling facilities and other ancillary equipment.

NOTE Some components are dealt with in other parts of this standard.

This standard applies to support units used at temperatures from -10° C to 60° C.

This standard also applies to support components and support accessories which are provided if the support unit is fitted with stowing equipment. This standard identifies and takes account of:

[1]) in preparation

- Possible hazards which may be caused by the operation of support units;
- Areas and operating conditions which may create such hazards;
- Hazardous situations which may cause injury or may be damaging to health;

This standard describes methods for the reduction of these hazards.

A list of hazards covered appears in clause 4.

This European standard does not establish the additional requirements for:

- Specially corrosive environments;
- Hazards occurring during construction, transportation, decommissioning;
- Earthquake.

This standard is applicable to all support units placed on the market for the first time, which are manufactured after the date on which this standard was published.

## 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 (including amendments).

EN 287-1 Approval testing of welders - Fusion welding - Part 1: Steels.

EN 288-1 Specification and approval of welding procedures for metallic materials - Part 1: General rules for fusion welding.

EN 288-2 Specification and approval of welding procedures for metallic materials - Part 2: Welding procedure specification for arc welding.

EN 288-3 Specification and approval of welding procedures for metallic materials - Part 3: Welding procedure tests for the arc welding of steels.

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 specification.

EN 1050:1996 Safety of machinery – Principles for risk assessment.

EN 1070 Safety of machinery – Terminology.

EN 1804-2 Machines for underground mines - Safety requirements for hydraulic powered roof supports - Part 2: Power set legs and rams.

prEN 1804-3 Machines for underground mines - Safety requirements for hydraulic powered roof supports – Part 3: Hydraulic control systems.

ENV 1993-1-1:1992 Eurocode 2: Design of steel structures - General rules and rules for buildings - General rules and rules for buildings.

EN 10002-1 Metallic material - Tensile testing - Part 1: Method of test.

EN 10025:1990 + A1:1993 Hot rolled products of non-alloy structural steels - Technical delivery conditions.

EN 10045-1 Metallic materials - Charpy impact test- Part 1: test method.

prEN 13463-1:1999 Non-electrical equipment for potentially explosive atmospheres- Part 1: Basic methodology and requirements.

EURONORM 103:1971 Microscopic determination of the ferrite or austenitic grain size of steels.

## 3 Terms and definitions

For the purposes of this standard the following terms and definitions apply.

**3.1**

**designs of hydraulic powered roof support**

**3.1.1**

**support unit**

type of hydraulic powered roof support, e.g. frame support, chock support, shield support, consisting of support components and support accessories

**3.1.2**

**frame support**

support unit in which the canopy and the base are connected to legs arranged in a line one behind the other to form one support unit

**3.1.3**

**chock support**

support unit in which the canopy and the base are connected to legs arranged one behind the other and side by side to form one support unit

**3.1.4**

**shield support**

support unit in which the canopy and the base are connected additionally via a goaf shield which lies within the flow of the support bearing force



**3.1.5**

**paired frame**

at least two support units arranged side by side moving lengthwise against each other using an advancing mechanism

**3.1.6**

**push-pull support**

at least two support units arranged one behind the other moving lengthwise against each other using an advancing mechanism

**3.2**

**support components**

all components which lie within the flow of the support bearing force

**3.2.1**

**canopy**

single or composite support component which transfers the support bearing force to the roof

**3.2.2**

**base**

single or composite support component which transfers the support bearing force to the floor

**3.2.3**

**goaf shield**

support component intended to absorb and transfer, fully or partially, the support bearing force and forces parallel to the seam between canopy and base. It is connected to the canopy and base either directly or

through a linkage. It generally shields the face area from the waste and is therefore subjected to a load from the caved material

**3.3**

**support accessories**

all components which do not lie within the flow of the support bearing force but which are necessary for the functioning of the powered roof support

**3.3.1**

**advancing mechanism**

device attached to the support unit for moving the support forwards

**3.3.2**

**sprag**

device attached to the support unit for supporting the working face

**3.3.3**

**forepoling device**

device used to protect the face area from caving materials

**3.4**

**anchoring device**

device for preventing uncontrolled movements of the conveying and extracting machines



**3.5**

**forces**



**3.5.1**

**yield force**

force produced by an actuator at the yield pressure of the pressure limitation valve, neglecting friction

**3.5.2**

**rated force**

maximum force for which the support unit or support component is designed. It is a calculated value which is determined from the support geometry neglecting friction

**3.5.3**

**support bearing force**

force borne by a support unit normal to the strata, which is a function of the support height and which occurs at the yield force

**3.5.4**

**test force**

measured force required to be applied to the support unit or support component to ensure that it is subjected to the rated force

**3.5.5**

**additional force**

force acting on the support unit, not produced by the strata or the support components

## 4 List of hazards

All the items in the following list of hazards refer to continuous operation and to installation and maintenance.

This list contains the hazards and hazardous situations, as far as they are dealt with in this European Standard, identified by risk assessment significant for this type of machinery and which require action to eliminate or reduce risk.

**Table 1 - List of hazards with cross references to safety requirements**

| No. | EN 1050:1996 | Safety requirements (clause) | Hazards |
|---|---|---|---|
| 1 | 1.1; 1.2; 1.3 | 5.1.1 | Crushing, shearing and cutting |
| 2 | 1.9 | 5.1.3 | fluid injection |
| 3 | 17 | 5.4.1 | Ejected parts |
| 4 | 1e | 5.1.6; 5.1.7; 5.3.1; 5.3.2; 5.3.4; 5.3.5; 5.3.6; 5.3.7;5.4.1;5.4.3; 5.5; 5.6; 5.7 | Fatigue or overload |
| 5 | 19; 21.1 | 5.1.1 | Slipping, stumbling and falling in the support |
| 6 | 2.4 | 5.4.3 | Electrical energy resulting from electro-static processes |
| 7 | 7.1 | 5.1.2 | Inhaling harmful dusts |
| 8 | 7.2 | 5.4.2 | Fire or explosion |
| 9 | 8.1; 8.2 | 5.1.1 | Neglecting ergonomic principles leading to unhealthy postures or excessive strain |
| 10 | | 5.1.8 | Incorrect assembly |
| 11 | 18; 30.1 | 5.2.1; 5.2.2; 5.3.7 | Tipping over, unexpected loss of stability |
| 12 | | 5.1.4 | Absence or incorrect installation of safety (protective) devices |
| 13 | | 5.1.5 | Absence or incorrect installation or important devices and auxiliaries for erection and repair |
| 14 | 1.C | 5.1.5; 5.1.7; 5.1.8; 5.2.1 | Potential energy of support unit parts which may move under the effect of gravity |



## 5 Safety requirements

### 5.1 General requirements

Hydraulic powered roof supports, which are designed according to this part of EN 1804, shall also meet the requirements of the other parts of EN 1804.

Support units should comply as appropriate with EN 292-1:1991 and EN 292-2:1991 + A1:1995 for hazards which are not covered by this standard.

### 5.1.1 Access

The travel-way through the support unit shall have minimum dimensions of 0,6 m in width and 0,4 m in height with corner profiles of minimum dimensions as given in Figure 1.

The walkways shall be designed to minimise slipping hazards e.g. by the use of ribbed plates.

Dimensions in millimeters

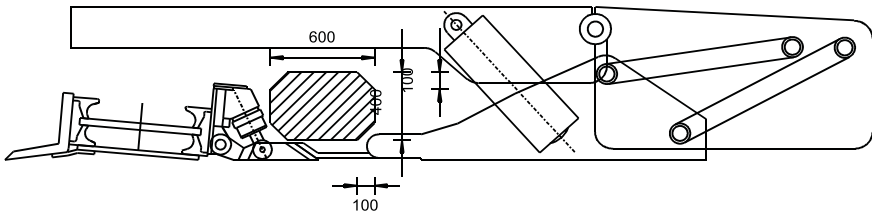


**Figure 1 - Minimum travel way**

### 5.1.2 Protection against dust

Provision shall be made in the design of support units for the installation of dust suppression equipment. That needs to be in accordance with the user's requirements (see clause 0, last indent).

NOTE Support units should be designed to seal the travel way from ingress of dust from the roof and goaf as far as possible.

### 5.1.3 Protection against ejected fluids

Support units shall be so designed that no hydraulic elements are damaged when used as intended.



### 5.1.4 Protection against face material spalling

Support units having a maximum extended height of 2,5 m or more shall be fitted with devices to which sprags can be attached.

The sprags shall be positively lockable when in the retracted position.



### 5.1.5 Lifting and pulling points

Support units shall have lifting and pulling points.

Lifting and pulling points shall be suitable for their intended purpose. They shall be designed to have a calculated minimum factor of safety of 4 on ultimate breaking load in relation to their intended load carrying capacity. They shall be clearly and permanently marked with their load carrying capacity, e.g. by welding.

### 5.1.6 Forepoling devices

Forepoling devices shall not lead to damage to other parts of the support unit when loaded with the rated force.

### 5.1.7 Prop anchorages

Canopies of hydraulic powered roof supports shall be equipped with anchorages for the top plates of the individual hydraulic props.

### 5.1.8 Correct assembly

It shall be possible to assemble the support unit correctly in accordance with the assembly instructions provided by the manufacturer.

## 5.2 Stability and alignment requirements

### 5.2.1 Tilt-resistance

When handled in accordance with the manufacturer's instructions support units in a freestanding state shall be stable over their whole adjustment range on all sides on a gradient of up to 15°.

In addition, they shall be stable in operation e.g. with external stabilising means.

### 5.2.2 Alignment

With support units for use in inclined seams with gradients of more than 30°, the alignment force (push or pull) of a support unit which is set shall be greater than the lateral weight component of three adjacent support units which are not set if these support units are no longer stable in the free-standing state.

## 5.3 Design requirements

### 5.3.1 Yield capability

Support units shall be designed for yielding to absorb convergence between the roof and the floor. During convergence the rated force shall not be exceeded by more than 20 %.

NOTE Support units should be designed in such a way that their function is impaired as little as possible by caved waste when lowering.

### 5.3.2 Behaviour when overloaded

Support components including face sprags shall be designed so that no failure occurs by bending, tension and compression when they are loaded up to 1,2 times the yield force of their respective actuators.

### 5.3.3 Eccentric loading

Support units shall be designed in such a way that their ability to function is not impaired in the presence of eccentric loading e.g. if the canopy is in contact with the roof on one side only.

### 5.3.4 Loading resulting from caving or stowing

Support units shall be capable of withstanding the caving or stowing forces resulting from over tipping when operated on a gradient when working an over tipped face. The forces and the gradients to be expected are normally be provided by the user (see clause 0 last indent).



### 5.3.5 Horizontal loading

Support units shall be designed to accommodate horizontal loads.

Shield supports shall withstand a horizontal force corresponding to 0,3 times the support bearing force without any damage to the support components.



All other support units shall either withstand the forces induced by the advancing mechanism or allow relative movement between canopy and base:

a) towards the waste, of at least 80 mm per metre of supported height and

b) in the coal face direction and to both sides, of at least 40 mm per metre of support height.

### 5.3.6 Operational performance

The operational performance of the support unit shall remain unimpaired when subjected to a total of at least 26 000 load cycles with various load configurations (see A.1.3).

### 5.3.7 Force introduction points of legs and rams

The force introduction points of actuators shall be capable of withstanding 1,5 times the maximum tensile force and the compression force which can be generated by the support hydraulics without their function being adversely affected.

## 5.4 Materials

### 5.4.1 Steel

#### 5.4.1.1 General

The manufacturer shall specify the steel grades and characteristics to be used.

The tensile strength of the steel grades used shall be at least 1,08 times the measured yield point or 0,2 % proof stress if the calculated stresses are more than 90 % of the permissible stresses (see 5.5).

The elongation prior to fracture A of the steel grades used shall not be less than 10 %, with the exception of steel grades used for pins where the elongation shall not be less than 9 %.

For thermal cutting of the steels, the steel manufacturers processing specifications shall be observed.

#### 5.4.1.2 Steel for welded support components

The steels shall be fully killed and either

a) conform to EN 10025:1990 + A1:1993, De-oxidation type FF or

b)

1) be of grain size 6 or finer as described in EURONORM 103:1971; and

2) shall have the following minimum impact values at a temperature of –20 °C:

20 J for steels with a 0,2 % proof stress of <620 N/mm²

25 J for steels with a 0,2 % proof stress of > 620 N/mm²

The values given shall be obtained regardless of the sample position, transverse or longitudinal to the direction of rolling.

The steels shall be weld able.

#### 5.4.1.3 Steel for non-welded support components

The steels shall be killed.

The impact values of the steel grades shall be at least 25 J at room temperature (20 °C).

### 5.4.2 Light metal

Surfaces consisting of light metal or light metal alloys (including paints and coatings containing light metal) of actuators intended by the manufacturer to be used in potentially gaseous mines shall meet the requirements of clause 8 of prEN 13463-1:1999.



### 5.4.3 Other materials

Other materials shall conform to the material specification laid down by the support unit manufacturer. When such materials are used for the manufacture of support components, equivalent performance characteristics to those specified for steel in 5.4.1 shall be proven. Non-metallic materials shall meet the requirements of clause 7 of prEN13463-1:1999.



## 5.5 Permissible stresses

### 5.5.1 General

Static load calculations shall be carried out for all support components.

Additional forces which stress a support component shall be taken into account.

The stresses in the support components determined by calculation either shall not exceed the permissible stresses given in 5.5.2 to 5.5.5 or the manufacturer shall demonstrate by theoretical or experimental methods that the support component performs in a safe manner.

### 5.5.2 Calculated axial stresses

For canopies, bases and footplates the calculated axial stresses shall not exceed the guaranteed minimum yield point or 0,2 % proof stress values of the materials. For other support components, the calculated axial stresses shall not exceed 85 % of these values.

### 5.5.3 Calculated shear stresses

The calculated shear stresses shall not exceed 80 % of the calculated axial stresses allowed for each support unit and load case.