
**Stroji za podzemne rudnike - Varnostne zahteve za hidravlično podporje - 2. del:
Deli hidravličnih stojk in potisnih cilindrov**

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

Maschinen für den Bergbau unter Tage - Sicherheitsanforderungen für hydraulischen Schreitausbau - Teil 2: Stempel und Zylinder

Machines pour mines souterraines - Exigences de sécurité relatives aux soutènements marchants applicables aux piles - Partie 2: Etançons et vérins à pose mécanisée

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Ta slovenski standard je istoveten z: EN 1804-2:2001+A1:2010

ICS:

73.100.10	Oprema za gradnjo predorov in podzemnih železnic	Tunnelling and tubbing equipment
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SIST EN 1804-2:2002+A1:2010**en,de**

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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1804-2:2001+A1

January 2010

ICS 73.100.10

Supersedes EN 1804-2:2001

English Version

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

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relatives aux soutènements marchants applicables aux
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Maschinen für den Bergbau unter Tage -
Sicherheitsanforderungen für hydraulischen Schreitausbau
- Teil 2: Stempel und Zylinder

This European Standard was approved by CEN on 21 September 2001 and includes Amendment 1 approved by CEN on 21 December 2009.

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 CEN 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 CEN Management Centre has the same status as the official versions.

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Foreword

This document (EN 1804-2:2001+A1:2010) has been prepared by Technical Committee CEN/TC 196 "Machines for underground mines - Safety", 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 July 2010, and conflicting national standards shall be withdrawn at the latest by July 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document includes Amendment 1, approved by CEN on 2009-12-21.

This document supersedes EN 1804-2:2001.

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

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document. **A1**

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

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Part 1: Support units and general requirements

Part 3: Hydraulic control systems

Part 4¹⁾: Electro-hydraulic control systems

Annexes A and B are 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, Bulgaria, Croatia, 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.

1) in preparation

EN 1804-2:2001+A1:2010 (E)**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;
- negotiations have taken place between the user and the manufacturer of the legs and rams (manufacturer of the roof support unit or final user in case of replacement parts) concerning the use of the machinery.

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1 Scope

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This standard specifies the safety requirements for legs and rams when used as specified by the manufacturer or his authorised representative. Examples covered by the standard include legs, support rams and rams with their mechanical extensions, internal valves and safety devices, seals, hydraulic connections (up to the first hose or Type B valve, see Part 3) and their lifting points but excluding protective pipes and gaiters, external valves and hydraulic and electrohydraulic control systems.

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

This standard applies to legs, support rams and rams used at ambient temperatures from –10 °C to 60 °C.

This standard identifies and takes account of:

- Possible hazards which may be caused by the operation of legs, support rams and rams;
- 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 standard is applicable to all legs, support rams and rams placed on the market for the first time and which are manufactured after the date on which this standard was published.

This European standard does not establish the additional requirements for:

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

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 292-2:1991 + A1:1995, *Safety of machinery - Basic concepts, general principles for design – Part 2: Technical principles and specifications*

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

<https://standards.iteh.ai/catalog/standards/sist/cafc437-1a36-4661-ab1b-188400000000/en-1050-1996>

EN 1804-1:2001, *Machines for underground mines - Safety requirements for hydraulic powered roof supports – Part 1: Support units and general requirements*

EN 1804-3, *Machines for underground mines - Safety requirements for hydraulic powered roof supports – Part 3: Hydraulic control systems*

EN 10002-1, *Metallic materials - Tensile testing – Part 1: Method of test*

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*

ISO 7745:1989, *Hydraulic fluid power - Fire-resistant (FR) fluids - Guidelines for use*

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

support unit

type of hydraulic powered roof support e.g. frame support, chock support, shield support, consisting of support components and support accessories [EN 1804-1:2001]

EN 1804-2:2001+A1:2010 (E)**3.2****support components**

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

3.2.1**actuator**

any type of hydraulic linear reciprocating device referred to in this standard

3.2.2**legs and support rams**

hydraulic actuators for producing the support bearing force of the support unit

3.2.3**single telescopic legs and support rams**

hydraulic legs and support rams with one extension stage

3.2.4**multi telescopic legs and support rams**

hydraulic legs and support rams with several extension stages

3.3**rams**

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

3.4**valve**

device for controlling the hydraulic functions

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3.5**pressures**

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3.5.1**setting pressure**

hydraulic pressure in the legs and support rams on completion of the setting procedure. This pressure is supplied by the hydraulic system

3.5.2**yield pressure of an actuator**

Hydraulic pressure in an actuator when the relevant pressure limiting valve is opened. This pressure in the actuator is induced by external forces (yield forces; see 3.5.2 of EN 1804-1:2001).

3.5.3**maximum permissible working pressure of an actuator**

maximum hydraulic pressure at which a hydraulic component is intended be operated and/or yielded

3.6**rated actuator force**

Maximum force to which an actuator is designed. It is a calculated value which is determined from the actuator geometry and the maximum permissible working pressure, neglecting friction.

3.7**functions****3.7.1****extension**

pushing out of the actuator operating piston by means of hydraulic pressure

3.7.2**retraction**

drawing in of the actuator operating piston by means of hydraulic pressure

3.7.3**setting**

extending of the support unit between the roof and the floor by pressuring the legs and support rams

3.7.4**yielding**

alteration in length of an actuator which occurs when external forces cause the yield pressure to be exceeded

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 as being 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	5.8	Crushing, shearing and cutting
2	1.9	5.2; 5.4	High pressure fluid jets
3	17	5.2; 5.6; 5.7; 5.8	Ejected parts
4	1e; 1.8	5.2; 5.5; 5.6; 5.7; 5.8; 5.10 to 5.13	Fatigue, overload; friction or wear
5	2.4	5.12.1	Electrical energy resulting from electrostatic phenomena
6	7.1	5.9	Inhalation of harmful fluids, mists and fumes
7	7.2	5.3; 5.12.2	Fire or explosion
8	17	5.4 to 5.14	Unexpected ejection of machine parts or fluids
9		5.15	Errors of fitting
10	27.8	5.1; 5.15	Absence or incorrect installation of devices and accessories for assembly and maintenance
11	10.6	5.1; 5.15	operating error
12	1.C	5.1; 5.15.	Potential energy of actuators parts which may move under the effect of gravity

5 Safety requirements**5.1 Lifting points**

Where lifting points are fitted to actuators they 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

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intended load carrying capacity. They shall be clearly and permanently marked with their load carrying capacity e.g. by welding.

5.2 Internal valves and safety devices

Actuators, that can be externally overloaded, shall be protected against excessive pressure.

This can be by means of

internal valves

external valves (see  EN 1804-3 )

safety devices such as bursting blanks.

The pressure in the piston compartment of hydraulic legs shall be capable of being monitored so that leakages are recognised in good time and hazards from inadequate strata control as a result of a pressure drop in the legs are avoided.

As a result of the type of fluid used and the small number of pressure cycles per day, actuators of hydraulic powered roof supports need neither to be self-bleeding nor shall they have external air bleeds.

In addition, internal valves, excluding constant yield valves, are covered by  EN 1804-3  of the standard.

5.3 Hydraulic fluids

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Actuators shall be designed such that they may be used with:

- a) fire-resistant fluids category HFA (ISO 7745:1989) specified by the support unit manufacturer in according to 6.2.1 of ISO 7745:1989

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or

- b) water without additives.

NOTE Hydraulic systems of roof supports, designed for coal mines and other mines with potentially explosive atmospheres, should be designed for use with non-toxic and fire-resistant fluids in accordance with SHCMOEI 7th Report (see Bibliography).

5.4 Protection against ejecting fluids

Actuators that intentionally eject fluid in to the atmosphere shall be designed to prevent any hazard due to the releasing fluid (e.g. by means of a guard).

5.5 Yield capability

Legs and support rams shall be designed such that at yield pressure they are capable of supporting the forces and the movements of attached components, see annex A (see 5.3.1 of EN 1804-1:2001).

5.6 Behaviour under axial overload

Legs and support rams, including their mechanical extensions, shall be designed so that their function is not affected if they are subjected statically to 1,5 times the rated compressive or tensile force and dynamically to a mechanical impact load resulting in 1,5 times the maximum permissible working pressure. (See annex A).

Where dynamic load testing is not practicable legs and support rams shall be subjected statically to 2 times the rated compressive or tensile force.

Rams, including their mechanical extension pieces, shall be designed so that their function is not affected if subjected statically to 1,5 times the rated compressive or tensile force. (See annex A).

In the fully retracted condition legs and support rams shall be capable of withstanding 2 times the rated compressive force.

5.7 Eccentric loading

Legs and support rams including their extension pieces shall be capable of withstanding eccentric and/or lateral forces without their function being impaired. (See annex A).

5.8 Functional reliability

The functional reliability of legs and supporting rams including their extension pieces shall not be impaired after 21000 load cycles. (See annex A).

5.9 Leak tightness

Pressure compartments of actuators shall be leak tight when isolated. (See annex A).

5.10 Extension limit

Extension limits of legs and support rams shall withstand a pressure of at least 80 % of the maximum permissible working pressure without damage when the fully extended piston is loaded 100 times with this pressure. If the design of the hydraulic circuitry of the support unit is such that it is possible operationally to generate pressures higher than 80 % of the maximum permissible working pressure, legs and support rams shall remain undamaged at these higher pressures and under the above mentioned conditions.

Rams shall withstand 1,5 times the maximum permissible working pressure when the piston is in fully extended in contact with the internal stop.

Support rams that are subjected to tensile load in operation shall not be damaged when they are fully extended in contact with the internal stop and loaded with 1,5 times the rated tensile force.

5.11 Force introduction points of actuators

The force introduction points of actuators and their extension pieces shall be capable of withstanding 1,5 times the rated actuator force without their function being affected.

5.12 Materials

5.12.1 Steel

5.12.1.1 General

The tensile strength of the steel grades used shall be at least 1,08 times the determined yield point or 0,2 % proof stress if the calculated stresses are more than 90 % of the permissible stresses (see 5.13.1).

The elongation at fracture (A) of the steel grades used shall be not less than 10 %.

5.12.1.2 Steel for welded actuator components

The steel shall be of fine grain, (ferrite grain size 6 or finer as described in EURONORM 103: 1971) and shall have an impact value of at least 27 J at a temperature of -20 °C.

EN 1804-2:2001+A1:2010 (E)**5.12.1.3 Steel for non-welded actuator components**

The steel used for the non-welded tubes of actuators shall have properties as described in 5.12.1.1 and 5.12.1.2.

The steel used for the other components shall have an impact value of at least 25 J at a temperature of 20 °C.

5.12.2 Light metal

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

5.12.3 Other materials

For materials that are used for the manufacturer of actuator components, equivalent ductility characteristics to those specified for steel in 5.12.1 shall be proven. Non-metallic materials shall meet the requirements of clause 7 of prEN 13463-1:1999.

5.12.4 Seals

Actuator seals shall full fill the test requirements given in annex A.

5.13 Calculated permissible stresses**5.13.1 Permissible stresses under axial central rated force conditions**

The axial stresses in the individual parts of the actuators shall not exceed 70 % of the guaranteed yield point, 0,2 % proof stress or compressive limit of the materials (also valid for annular stresses as a result of fluid pressure).

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The axial stresses in the bases of actuators shall not exceed 80 % of the guaranteed yield point, 0,2 % proof stress or compressive limit of the materials.

The shear stresses shall not exceed 65 % of the guaranteed yield point, 0,2 % proof stress or compressive limit of the materials.

5.13.2 Permissible stresses under double axial central rated force conditions

In the case of twice the central rated force in the fully retracted state of legs and support rams, the stresses shall not exceed the guaranteed yield point or 0,2 % proof stress of the materials.

NOTE This requirement only involves mechanical loading. There are no hydraulic pressures.

5.13.3 Permissible stresses under eccentric rated force conditions

In the case of the eccentric rated force as described in A.1.3.1 the axial stresses of the leg and support ram components involved in bending shall not exceed the guaranteed yield point or 0,2 % proof stress or compressive limit of the materials. The deflections determined by means of a test as specified in A.1.3.2 shall be used as a basis for calculating the stresses.

In the case of an eccentric rated force and simultaneous lateral loading (e.g. to stabilize the support unit), the axial stresses of the leg and support ram components involved in bending shall not exceed the guaranteed yield point or 0,2 % proof stress or compressive limit of the materials.