SLOVENSKI STANDARD
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SIST EN 1804-2:2002+A1:2010

Stroji za podzemne rudnike - Varnostne zahteve za hidravlično podporje - 2. del: Hidravlične stojke in potisni hidravlični valji

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

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

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EUROPEAN STANDARD

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

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European foreword

This document (EN 1804-2:2020) has been prepared by Technical Committee CEN/TC 196 “Mining machinery and equipment - 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of an identical text or by endorsement, at the latest by June 2021, and conflicting national standards shall be withdrawn at the latest by June 2021.

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

This document supersedes EN 1804-2:2001+A1:2010.

The main differences between this document and EN 1804-2:2001+A1:2010 are as follows:

a) Normative references (updated);

b) Terms and definitions (modified);

c) List of significant hazards (revised) (see Annex C);

d) Requirements for steel (updated/modified);

e) Requirements for static and dynamic overload (revised/modified);

f) Requirements for overload fully retracted (deleted);

g) List of tests (updated) (see Annex B).

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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).

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

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

This document is a type C standard, as specified in EN ISO 12100:2010.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

— machine manufacturers (small, medium and large enterprises);

— health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

— machine users/employers (small, medium and large enterprises);

— machine users/employees (e.g. trade unions, organizations for people with special needs);

— service providers, e.g. for maintenance (small, medium and large enterprises);

— consumers (in the case of machinery intended for use by consumers).

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The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

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The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

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When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements of this type-C standard take precedence over the requirements of the other standards for machines that have been designed and built according to the requirements of this type-C standard.

The extent to which hazards are covered is indicated in the scope of this document. When drawing up this standard, the underlying assumptions were that:

— only trained and qualified personnel operate the machine;

— components without specific requirements are:

  — designed in accordance with the usual engineering practice and calculation codes;

  — of sound mechanical construction;

  — are free of defects;

— components are kept in good working order;

— the implementation conditions and requirements imposed on the machine have been agreed between manufacturer of the legs and cylinders and their user (manufacturers of the support unit or users in the case of spare parts).

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1 Scope

This document stipulates the safety requirements for use of legs and rams as intended by the manufacturer. These include legs, support rams and rams, including the mechanical extensions, the inner valves and safety devices, seals, the hydraulic connections (up to the 1st hose line or to the valve of design B, see EN 1804-3:2020) and their lifting points, but excluding protective pipes and gaiters, external valves and hydraulic and electrohydraulic control systems.

NOTE Some components are discussed in other parts of this standard series.

This document applies for legs, support rams, and cylinders that are used at ambient temperatures between –10 °C and 60 °C.

This document identifies and takes account of:

— possible hazards which may be caused by the operation of legs, support rams and rams;

— the hazardous areas and the operating conditions that can cause any type of hazard;

— the situations that can result in hazards that cause an injury or impair health;

— dangers that can be caused through mine gas and/or flammable dusts.

This document describes methods for reducing these hazards.

Clause 4 contains a list of the hazards discussed.

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This document does not specify any additional requirements for:

— specially corrosive environments;

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— risks associated with manufacturing and decommissioning;

— earthquake.

A complete hydraulic powered roof support consists of the support units (EN 1804-1:2020), legs and support rams (EN 1804-2:2020) and the hydraulic and electro hydraulic controls (EN 1804-3:2020). Each part of this multipart document addresses the safety requirements of the components mentioned in the scopes of the respective parts of this multipart series.

This document is not applicable to legs and rams manufactured before the date of its publication.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1090-1:2009+A1:2011, *Execution of steel structures and aluminium structures — Part 1: Requirements for conformity assessment of structural components*

EN 1804-1:2020, *Machines for underground mines — Safety requirements for hydraulic powered roof supports — Part 1: Support units and general requirements*

EN 1804-3:2020, *Machines for underground mines — Safety requirements for hydraulic powered roof supports — Part 3: Hydraulic and electro hydraulic control systems*

EN 10204:2004, *Metallic products — Types of inspection documents*

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EN ISO 148-1:2016, *Metallic materials — Charpy pendulum impact test — Part 1: Test method (ISO 148-1:2016)*

EN ISO 643:2020, *Steels — Micrographic determination of the apparent grain size (ISO 643:2019, Corrected version 2020-03)*

EN ISO 6892-1:2019, *Metallic materials — Tensile testing — Part 1: Method of test at room temperature (ISO 6892-1:2019)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 15614-1:2017,[1] *Specification and qualification of welding procedures for metallic materials — Welding procedure test — Part 1: Arc and gas welding of steels and arc welding of nickel and nickel alloys (ISO 15614-1:2017, Corrected version 2017-10-01)*

EN ISO 80079-36:2016, *Explosive atmospheres — Part 36: Non-electrical equipment for explosive atmospheres — Basic method and requirements (ISO 80079-36:2016)*

ISO 7745:2010, *Hydraulic fluid power — Fire-resistant (FR) fluids — Requirements and guidelines for use*

3 Terms and definitions

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For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN 1804-1:2020, EN 1804-3:2020 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

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— IEC Electropedia: available at http://www.electropedia.org/

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

[SOURCE: EN 1804-1:2020, definition 3.1.1]

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 document

3.2.2
legs and support rams
hydraulic actuators for producing the support bearing force of the support unit

[1] As impacted by EN ISO 15614-1:2017/A1:2019.

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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
control devices
3.4.1
valve
device for controlling the flow of hydraulic fluid

3.4.2
bursting blank
single acting hydraulic fuse

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3.4.3
internal valve
valve inside actuator without access from outside

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3.4.4
external valve
valve attached outside of the actuator

3.4.5
safety devices
type A valves according to EN 1804-3:2020

3.5
pressures
3.5.1
setting pressure
hydraulic pressure in the legs and support rams on completion of the setting procedure

Note 1 to entry: 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

Note 1 to entry: This pressure in the actuator is induced by external forces (yield forces; see EN 1804-1:2020, 3.5.1).

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

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3.6
rated actuator force
maximum force to which an actuator is designed

Note 1 to entry: 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

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4 Safety requirements

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4.1 General

Machinery shall comply with the safety requirements and/or protective/risk reduction measures of this clause. In addition, the machine shall be designed according to the principles of EN ISO 12100:2010 for relevant but not significant hazards which are not dealt with by this document.

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

4.3 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 1804-3:2020);

— 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 recognized in good time and hazards from inadequate strata control as a result of a pressure drop in the legs are avoided.

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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 1804-3:2020.

4.4 Pressurized fluids

Actuators shall be either designed such that they use:

a) fire-resistant fluids category HFA (ISO 7745:2010) specified by the support unit manufacturer in accordance with ISO 7745:2010, 6.2.1;

or

b) water without additives (temperatures from +5 °C to +60 °C).

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).

4.5 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).

4.6 Yield capability

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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 and see EN 1804-1:2020, 4.3.1.

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4.7 Behaviour under axial overload

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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);

or

— they are subjected statically to 2 times the rated compressive or tensile force. After the load test, the function may be impaired, but it shall not burst nor shall parts or fluid be ejected.

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).

4.8 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).

4.9 Functional reliability

The functional reliability of legs and supporting rams including their extension pieces shall not be impaired after 21 000 load cycles (see A.1.4.1 and A.1.4.2).

4.10 Leak tightness

Pressure compartments of actuators shall be leak tight when isolated (see Annex A).

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4.11 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.

4.12 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.

4.13 Materials

4.13.1 Steel

4.13.1.1 General

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The materials of the support parts shall be specified by the manufacturer with consideration of the following requirements. Verification of the properties shall be provided with Acceptance Certificate 3.1 in accordance with EN 10204:2004 or better.

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The ultimate tensile strength of the types of steel used shall be at least 1,08 × the determined yield strength or 0,2 % elasticity limit, if the calculated stresses are more than 90 % of the permissible stresses (see 4.13.1).

The elongation prior to fracture A of the steel grades used shall not be less than 10 %.

4.13.1.2 Steel for welded actuator components

The steel shall be of fine grain, (ferrite grain size 6 or finer as described in EN ISO 643:2020) and shall have an impact value of at least 27 J at a temperature of −20 °C.

4.13.1.3 Steel for non-welded actuator components

The steel used for the non-welded tubes of actuators shall have properties as described in 4.13.1.1 and 4.13.1.2.

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

4.13.2 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 EN ISO 80079-36:2016, 6.4.4.

4.13.3 Materials other than steel

For materials that are used for the manufacture of actuator components, equivalent ductility characteristics to those specified for steel in 4.13.1 shall be proven. Non-metallic materials shall meet the requirements of EN ISO 80079-36:2016, 7.4.