SLOVENSKI STANDARD
SIST EN 1804-1:2021

01-april-2021

Nadomešča:
SIST EN 1804-1:2002+A1:2010

Stroji za podzemne rudnike - Varnostne zahteve za hidravlično podporje - 1. del: Podporne enote in splošne 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 soutènements marchants applicables aux piles - Partie 1 : Unités de soutènement et exigences générales

Ta slovenski standard je istoveten z: **EN 1804-1:2020**

ICS:

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

SIST EN 1804-1:2021 **en,fr,de**

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1804-1

December 2020

ICS 73.100.10

Supersedes EN 1804-1:2001+A1:2010

English Version

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

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This European Standard was approved by CEN on 25 October 2020.

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

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Ref. No. EN 1804-1:2020 E

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European foreword

This document (EN 1804-1:2020) 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of an identical text or by endorsement, at the latest by June 2021, and conflicting national standards shall be withdrawn at the latest by June 2021.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 1804-1:2001+A1:2010.

The main differences between this document and EN 1804-1:2001+A1:2010 are as follows:

a) Normative references (updated);

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

c) Requirements for prop anchorages (deleted);

d) Requirements for steel for welded components (updated/modified);

e) List of tests for confirmation (updated);

f) Acceptance criteria for test results (modified);

g) Measurement and criteria for deformation after the test (added);

h) Requirements for convergence test (modified);

i) Cyclic fatigue test for canopy side shield (added);

j) Figures and pictures (revised/added).

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.

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).

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

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

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 creating this standard it was assumed that:

— only trained and qualified personnel would operate the machine;

— components for which no specific requirements have been formulated:

  — have been constructed in accordance with generally accepted engineering practice and generally accepted calculation methods;

  — have been well manufactured mechanically;

  — are free of defects;

— the components are kept in good operational condition;

— the implementation conditions and requirements imposed on the machine have been agreed between manufacturer and user.

1 Scope

This document stipulates the safety requirements for the use of support units intended by the manufacturer. 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 document 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 discussed in other parts of this series of standards.

This document applies for support units that are used at ambient temperatures between −10 °C and 60 °C.

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

— the hazards that can possibly be induced through operation of the support units;

— 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.

This document does not specify any additional requirements for:

— a particularly corrosive environment;

— risks associated with manufacturing, transport 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 all support units 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 1804-2:2020, *Machines for underground mines — Safety requirements for hydraulic powered roof supports — Part 2: Power set legs and rams*

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

EN 1993-1-1:2005,[1] *Eurocode 3: Design of steel structures — Part 1-1: General rules and rules for buildings*

EN 1993-1-8:2005,[2] *Eurocode 3: Design of steel structures — Part 1-8: Design of joints*

EN 1993-1-9:2005,[3] *Eurocode 3: Design of steel structures — Part 1-9: Fatigue*

EN 1993-1-10:2005,[4] *Eurocode 3: Design of steel structures — Part 1-10: Material toughness and through-thickness properties*

EN 10025-1:2004, *Hot rolled products of structural steels — Part 1: General technical delivery conditions*

EN 10025-2:2019, *Hot rolled products of structural steels — Part 2: Technical delivery conditions for non-alloy structural steels*

EN 10025-3:2019, *Hot rolled products of structural steels — Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels*

EN 10025-4:2019, *Hot rolled products of structural steels — Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels*

EN 10025-5:2019, *Hot rolled products of structural steels — Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance*

EN 10025-6:2019, *Hot rolled products of structural steels — Part 6: Technical delivery conditions for flat products of high yield strength structural steels in the quenched and tempered condition*

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

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

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,[5] *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)*

[1] As impacted by EN 1993-1-1:2005/AC:2009 and EN 1993-1-1:2005/A1:2014.
[2] As impacted by EN 1993-1-8:2005/AC:2009.
[3] As impacted by EN 1993-1-9:2005/AC:2009.
[4] As impacted by EN 1993-1-10:2005/AC:2009.
[5] As impacted by EN ISO 15614-1:2017/A1:2019.

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010, EN 1804-2:2020 and 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

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

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

Note 1 to entry: 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 (flipper)
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 limitating valve, neglecting friction

3.5.2
rated force
maximum force for which the support unit or support component is designed.

Note 1 to entry: 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 Safety requirements

4.1 General requirements

4.1.1 General

Hydraulic powered roof support that is constructed in accordance with this document shall also satisfy the requirements stipulated in the other parts of EN 1804.

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.

4.1.2 Walkway

The walkway through the support unit shall ensure the minimum dimensions of 0,6 m in width and 0,4 m clearance height (permissible tapering on the corners, see Figure 1).

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

Dimensions in millimetres

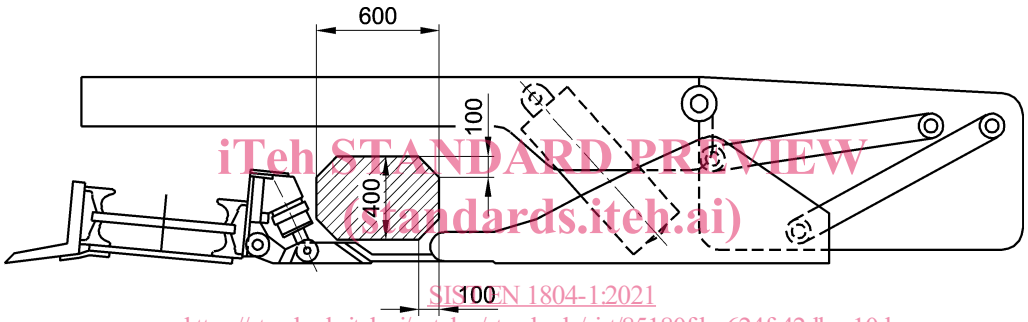

Figure 1 — Minimum walkway

4.1.3 Protection against dust

Support units shall be designed in such a manner that appropriate equipment for dust control can be installed.

Support units should be designed in such a manner that they seal the walkway against dust ingress from the roof and goaf.

4.1.4 Protection against ejected fluids

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

4.1.5 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.

4.1.6 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.

4.1.7 Forepoling devices

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

4.2 Stability and alignment requirements

4.2.1 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 stabilizing means.

4.2.2 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.

4.3 Design requirements

4.3.1 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 %.

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

4.3.2 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.

4.3.3 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.

4.3.4 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 introduction, last paragraph).

4.3.5 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) in the direction of the goaf, at least 80 mm per metre of support height; and

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

4.3.6 Fatigue strength

The fatigue strength 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).

4.3.7 Force transmission points of legs and cylinders

The force transmission 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.

4.4 Materials

4.4.1 Steel

4.4.1.1 General

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.

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 4.5).

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 processing guidelines issued by the manufacturer of the steel shall be complied with.

4.4.1.2 Steel for welded support components

a) The steel shall correspond to EN 10025-1:2004, EN 10025-2:2019, EN 10025-3:2019, EN 10025-4:2019, EN 10025-5:2019 and EN 10025-6:2019.

   And it shall have at least the following impact values at a temperature of −20 °C:

   — 20 J for steels with a yield strength or 0,2 % elasticity limit < 620 N/mm²;

   — 25 J for steels with a yield strength or 0,2 % elasticity limit > 620 N/mm².

   The specified values shall be provided, regardless of the position of sample – transverse ***or*** longitudinal to the rolling direction.

or

b) The steel shall:

1) have a ferrite grain size of 6 or finer, in accordance with EN ISO 643:2020 and

2) at a temperature of −20 °C have at least the following impact values:

— 20 J for steels with a yield strength or 0,2 % elasticity limit < 620 N/mm²;

— 25 J for steels with a yield strength or 0,2 % of the elasticity limit ≥ 620 N/mm².

The specified values shall be provided, regardless of the position of sample – transverse ***or*** longitudinal to the rolling direction.

The steels shall be suitable for welding.

Preferably the requirements in accordance with a) shall be satisfied.

4.4.1.3 Steel for non-welded support components

The steels shall be killed.

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

4.4.2 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 EN ISO 80079-36:2016, 6.4.4.

4.4.3 Materials other than steel

When such materials are used for the manufacture of support components, equivalent performance characteristics to those specified for steel in 4.4.1 shall be proven. Non-metallic materials shall meet the requirements of EN ISO 80079-36:2016, 7.4.

4.5 Permissible stresses

4.5.1 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 4.5.2 to 4.5.5 or the manufacturer shall demonstrate by theoretical or experimental methods that the support component performs in a safe manner.

4.5.2 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.

4.5.3 Calculated shear stresses

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