
**Stroji za podzemno pridobivanje – Varnostne zahteve za hidravlično nosilno
podporje – 4. del: Elektrohidravlični krmilni sistemi**

(istoveten prEN 1804-4:2004)

Machines for underground mines - Safety requirements for hydraulic powered roof
supports - Part 4: Electro-hydraulic control systems

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Machines for underground mines - Safety requirements for hydraulic powered roof supports - Part 4: Electro-hydraulic control systems

Machines pour mines souterraines - Exigences de sécurité relatives aux soutènements marchants applicables aux piles - Partie 4 : Systèmes de commande électro-hydrauliques

Maschinen für den Bergbau unter Tage - Sicherheitsanforderungen an hydraulischen Schreitausbau - Teil 4: Elektrohydraulische Steuerungen

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Foreword

This document (prEN 1804-4:2004) has been prepared by Technical Committee CEN/TC 196 “Machines for underground mines - Safety”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

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 4 of a European Standard specifying the safety requirements for hydraulic powered roof supports.

The other parts are:

Part 1: Support units and general requirements

Part 2: Power set legs and rams

Part 3: Hydraulic control systems

Annexes A and B are normative. Annexes C and ZA are informative.

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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 this standard.

While preparing 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 methods;
 - b) of sound mechanical and electrical construction;
 - c) free from defects;
- components are kept in good working order;
- a consultation took place between the manufacturer of the electro-hydraulic control systems and the user (manufacturer of the support unit or user in the case of replacement parts) concerning the conditions of use of the machinery.

1 Scope

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This standard specifies the safety requirements for electro-hydraulic control devices for support units, including their emergency stop, pre-start warning, monitoring and control devices, when used as specified by the manufacturer or his authorized representative.

The requirements of EN 1804 Part 3 also apply to the hydraulic components of the electro-hydraulic control systems

This standard applies to electro-hydraulic control systems used at ambient temperatures from –10 °C to 40 °C and operating temperatures from –10 °C to 60 °C.

This standard identifies and takes into account:

- possible hazards which can be caused by the operation of hydraulic control devices;
- areas and operating conditions which can create such hazards;
- hazardous situations which can cause injury or may be damaging to health;
- hazards which can be caused by firedamp and/or flammable dust.

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 electro-hydraulic control devices placed on the market for the first time which are manufactured after the date on which this standard was issued.

This European Standard does not specify any additional requirements for:

- cable less remote control systems;
- specially corrosive environments;
- hazards occurring during construction, transportation, decommissioning;
- earthquakes.

2 Normative references

The following referenced documents are indispensable for the application 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 457:1992, *Safety of machinery — Auditory danger signals — General requirements, design and testing (ISO 7731:1986, modified)*.

EN 954-1:1996, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design*.

EN 981:1996, *Safety of machinery — System of auditory and visual danger and information signals*.

EN 1050, *Safety of machinery — Principles for risk assessment*.

EN 1070, *Safety of machinery — Terminology*.

EN 1127-2:2002, *Explosive atmospheres — Explosion prevention and protection — Part 2: Basic concepts and methodology for mining*.

prEN 1710, *Equipment and components intended for use in potentially explosive atmospheres in mines*.

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

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*.

EN ISO 12100-2:2003 *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles (ISO 12100-2:2003)*.

EN 13463-1:2001, *Non-electrical equipment for potentially explosive atmospheres — Part 1: Basic method and requirements*.

EN 50014:1997+A1+A2, *Electrical apparatus for potentially explosive atmospheres — General requirements*.

EN 50015:1998, *Electrical apparatus for potentially explosive atmospheres — Oil immersion "o"*.

EN 50017:1998, *Electrical apparatus for potentially explosive atmospheres — Powder filling "q"*.

EN 50018:2000+A1:2002, *Electrical apparatus for potentially explosive atmospheres — Flameproof enclosure "d"*.

- EN 50020:2002, *Electrical apparatus for potentially explosive atmospheres — Intrinsic safety "i"*.
- EN 50028:1987, *Electrical apparatus for potentially explosive atmospheres — Encapsulation "m"*.
- EN 50281-1-1:1998, *Electrical apparatus for use in the presence of combustible dust — Part 1-1: Electrical apparatus protected by enclosures — Construction and testing*.
- EN 55011, *Industrial, scientific and medical (ISM) radio-frequency equipment — Radio disturbance characteristics — Limits and methods of measurement (CISPR 11:1997, modified)*.
- EN 55014-1, *Electromagnetic compatibility — Requirements for household appliances, electric tools and similar apparatus — Part 1: Emission (CISPR 14-1:2000)*.
- EN 55014-2, *Electromagnetic compatibility — Requirements for household appliances, electric tools and similar apparatus — Part 2: Immunity product family standard (CISPR 14-2:1997)*.
- EN 55022, *Information technology equipment — Radio disturbance characteristics — Limits and methods of measurement (CISPR 22:1997, modified)*.
- EN 60079-7:2003, *Electrical apparatus for explosive gas atmospheres — Part 7: Increased safety "e" (IEC 60079-7:2001)*.
- EN 60079-25:2004, *Electrical apparatus for explosive gas atmospheres — Part 25: Intrinsically safe systems (IEC 60079-25:2003)*.
- EN 60204-1:1997, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements*.
- EN 60529:1991+A1:2000, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*.
- EN 61000-4-2, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 2: Electrostatic discharge immunity test — Basic EMC publication (IEC 61000-4-2:1995)*.
- EN 61000-4-3, *Electromagnetic compatibility (EMC) — Part 4-3: Testing and measurement techniques — Radiated, radio-frequency, electromagnetic field immunity test (IEC 61000-4-3:2002)*.
- EN 61000-4-4, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 4: Electrical fast transient/burst immunity test — Basic EMC publication (IEC 61000-4-4:1995)*.
- EN 61000-4-5, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 5: Surge immunity test (IEC 61000-4-5:1995)*.
- EN 61000-4-6, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 6: Immunity to conducted disturbances, induced by radio-frequency fields (IEC 61000-4-6:1996)*.
- EN 61000-4-8, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 8: Power frequency magnetic field immunity test — Basic EMC publication (IEC 61000-4-8:1993)*.
- EN 61000-4-11, *Electromagnetic compatibility (EMC) — Part 4: Testing and measurement techniques — Section 11: Voltage dips, short interruptions and voltage variations immunity tests (IEC 61000-4-11:1994)*.
- ISO 6805, *Rubber hoses and hose assemblies for underground mining — Wire-reinforced hydraulic types for coal mining — Specification*.
- IEC 60038-2-6, *Environmental testing — Part 2: Tests — Test Fc: Vibration (sinusoidal)*.
- IEC 60038-2-27, *Environmental testing — Part 2: Tests — Test Ea and guidance: Shock*.
- IEC 60038-2-32, *Basic environmental testing procedures — Part 2: Tests — Test Ed: Free fall*.

IEC 60038-2-38, *Environmental testing — Part 2: Tests — Test Z/AD: Composite temperature/humidity cyclic test*.

IEC 60870-5-1, *Telecontrol equipment and systems — Part 5: Transmission protocols — Section 1: Transmission frame formats*.

3 Terms and definitions

For the purposes of this European Standard, the definitions given in EN 1070 apply as far as relevant for this standard and those of the EN 1804 series of standards and the following apply

3.1 types of control systems

3.1.1 unit control system

control system in which individual functions of a support unit are operated from within that support unit

3.1.2 adjacent control system

type of control system in which the individual functions of one support unit are manually operated from an adjacent support unit (see EN 1804-3:2004)

3.1.3 sequence control system

control system in which a functional sequence, (e.g. lowering - advancing - setting) operates in one single support unit (see EN 1804-3:2004)

3.1.4 batch sequence control system

control system in which a series of sequence controls are carried out consecutively in a specified number of support units

3.1.5 positive setting control system

control system where the setting function of legs and/or support rams and any front cantilever is operated automatically at least until the rated value of the setting pressure to the legs and/or support rams in the support unit has been attained or a timing system operates

3.1.6 automatic synchronized fore pole control system

control system where the fore pole is operated as a function of the stroke of the advancing ram

3.1.7 automatic water spray control

3.1.7.1 automatic canopy water spray control system

control system where the canopy water spray system is operated as a function of the time/date and/or position of the mineral production machine and/or the internal condition of the working face or the shield

3.1.7.2 automatic water curtain control system

control system where the water spraying system for the mineral production machine track is operated as a function of the mineral production machine position, direction and speed of travel, and direction of ventilation

3.1.8**automatic control system for conveyor push**

control system which pushes the conveyor automatically by initiated different criteria

3.1.9**automatic conveyor horizon control system**

control system where the transverse inclination of the conveyor above the steering ram is controlled as a function of the position and direction of travel of the mineral production machine, the rate of advance and the inclination of the conveyor from set points

3.1.10**automatic base lift control system**

control system where the base lift ram(s) are operated as a function of the movement of the support unit

3.1.11**automatic conveyor creep control system**

control system where the anchor rams can be control by a number of functions including the movement of the support unit, the position and direction of travel of the mineral production machine

3.1.12**automatic face sprag control system**

control system where the face sprags are operated as a function of the position and direction of travel of the mineral production machine and the movement of the support unit

3.1.13**automatic control system for the stabilizing ram**

control system where the stabilizing ram(s) are operated as a function of the movement of the support unit and of the pressure in the legs

3.1.14**automatic control system for support steering**

control system where the steering rams of the advancing support and of the adjacent support units are operated in order to steer the advancing support unit

3.1.15**automatic control system for conveyor pullback**

control system where the conveyor is pulled back a specified amount

3.1.16**limited remote**

control system where support units beyond the adjacent unit (e. g. next but one) are operated as in the normal adjacent control mode (visible range)

3.1.17**remote control**

control system where support units are controlled by a means other than adjacent control

3.1.18**cable less control unit**

control system where data and control commands are transmitted by a means other than galvanic or fibre-optic connections

3.1.19**minimum setting pressure for pushing the conveyor**

minimum pressure in at least one of the legs of the support unit to allow automatic pushing of the conveyor

3.1.20**minimum setting pressure for pulling back the conveyor**

minimum pressure in at least one leg of the support unit to allow automatic pulling back of the conveyor

3.1.21

transfer pressure

minimum pressure in at least one leg of a support unit to allow an auto sequence in the adjacent support unit(s)

3.1.22

residual leg pressure

maximum pressure in at least one leg of the support unit to allow that support unit to be advanced

3.1.23

control device

device by which control commands can be given

3.1.24

auditory warning signal

signal indicating the possibility or actual occurrence of a dangerous situation requiring appropriate measures for the elimination or control of the danger and indications concerning the conduct and course of action to be taken (see EN 457, 3.1.1)

3.1.25

visible warning signal

visible signal indicating the imminent onset of a dangerous situation requiring appropriate measures for the elimination or control of the danger (see EN 842, 3.1.1)

3.1.26

normal stop device

device for interrupting the progress of the automatic support sequence

3.1.27

single function

single movement in a support unit

3.1.28

electro-hydraulic control device

control device combining electrical and hydraulic elements

3.1.29

transducer

device converting physical variables (e. g. distances, pressures) into electrical signals

3.1.30

electromechanical actuator

device converting electrical energy into mechanical energy.(e. g. solenoid)

3.1.31

emergency stop device

arrangement of components intended to achieve the emergency stop function (see EN 418:1992)

3.1.32

emergency stop function for support units

function which interrupts movements immediately in case of emergency and which prevents restart

3.1.33

program

specifies the relationship between input signals and output functions or commands for a control unit

3.1.34

locked-on function

an initiated function retained until deliberately cancelled

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3.1.35**manual in support control**

mode of operation in which single functions are operable only by hydraulic controls in that support unit

3.1.36**local lockout**

device ensuring that individual support units are prevented from electrical activation

3.1.37**control units****3.1.37.1****control unit**

device in which control commands are processed

3.1.37.2**central control unit**

control unit for gathering, processing, transmitting and displaying face data. It provides communication with other control units and can be used for controlling support units

3.1.37.3**underground central control unit**

central control unit mounted in the face end or gate area and conforming to the requirements for use below ground

3.1.37.4**surface central control unit**

central control unit installed above ground

3.1.37.5**single control unit**

control unit mounted in a support unit or used as a portable device on the face

3.1.37.6**user interface**

single control unit with which commands can be given and/or information received

3.1.37.7**cabled user interface**

single control unit that communicates by cable with other control units

3.1.37.8**cable less user interface**

single control unit that communicates with other control units without the use of a cable

3.1.37.9**integral user interface**

single control unit that is incorporated into another control unit

3.1.37.10**electromechanical actuator/transducer interface module**

control unit that is connected between a support control unit and electromechanical actuators or transducers

3.1.37.11**installation control unit**

control unit used to install and withdraw support units

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3.1.37.12

support control unit

control unit in a support unit that receives and processes data, outputs control commands for the support unit and relays control commands for connected control units

3.1.38

pushbutton override control (dead man control)

function that remains active for as long a pushbutton is pressed

3.1.39

ambient temperature

average temperature measured in the general body of air across the face length when all the equipment associated with the face is installed but not working when the temperature has normalized at the specified minimum ventilation quantity

3.1.40

operating temperature

maximum surface temperature of a device or component under normal operating conditions

NOTE This is influenced by the ambient temperature, the proximity of the working fluid or other components, any self-generating thermal effect and its location within the support unit

3.1.41

safe state of electro-hydraulic control system

state in which all outputs to actuators are disabled

3.1.42

installation control unit

control unit used to install and withdraw support units

3.1.43

face safety valve

electro-hydraulic control device which shuts off the hydraulic power supply and depressurizes the main feed line(s) to the face

3.1.44

test device

apparatus used to verify the functionality of other defined items of equipment, e. g. control device, or to evaluate system performance

4 List of hazards

The following list of significant hazards relates in all points to continuous operation and to setting up 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

No. in EN 1050: 1997	Hazards	EN 1804-4 Hazards
Hazards, hazardous situations and hazardous events		
1	Mechanical hazards due to	
	Machine parts or workpieces, e. g.:	5.1
	shape;	5.1.2
	relative location;	5.1.3
	mass and stability (potential energy of elements which may move under the effect of gravity);	5.2.8
	mass and velocity (kinetic energy of elements in controlled or uncontrolled motion);	not significant
	inadequacy of mechanical strength;	5.2.1
	accumulation of energy inside the machinery, e. g.:	not significant
	elastic elements (springs);	not significant
	liquids and gases under pressure;	not significant
	the effect of vacuum.	not significant
1.1	Crushing hazard	5.1, 5.2.8, 5.4
1.2	Shearing hazard	5.1, 5.2.8, 5.4
1.3	Cutting or severing hazard	5.1, 5.2.8, 5.4
1.4	Entanglement hazard	not significant
1.5	Drawing-in or trapping hazard	not significant
1.6	Impact hazard	not significant
1.7	Stabbing or puncture hazard	not significant
1.8	Friction or abrasion hazard	5.2.1
1.9	High pressure fluid injection or ejection hazard	5.5.1.6.14
2	Electrical hazards due to	
2.1	Contact of persons with live parts (direct contact)	5.2.1
2.2	Contact of persons with parts which have become live under faulty conditions (indirect contact)	5.1.5, 5.2.1
2.3	Approach to live parts under high voltage	not significant
2.4	Electrostatic phenomena	5.1.1
2.5	Thermal radiation or other phenomena such as the projection of molten particles and chemical effects from short circuits, overloads, etc.	not significant
3	Thermal hazards , resulting in:	
3.1	Burns, scalds and other injuries by a possible contact of persons with objects or materials with an extreme high or low temperature, by flames or explosions and also by the radiation of heat sources	not significant
3.2	Damage to health by hot or cold working environment	not significant
4	Hazards generated by noise , resulting in	
4.1	Hearing loss (deafness), other physiological disorders (e. g. loss of balance, loss of awareness)	5.5.1.6.15, 5.5.1.6.16
4.2	Interference with speech communication, acoustic signals, etc.	5.5.1.6.15, 5.5.1.6.16