SLOVENSKI STANDARD
SIST EN 14591-2:2007

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Preprečevanje eksplozij in zaščita v podzemnih rudnikih - Zaščitni sistemi - 2.del: Pasivne vodne prepreke

Explosion prevention and protection in underground mines - Protective systems - Part 2: Passive water trough barriers

Explosionsschutz in untertägigen Bergwerken - Schutzsystems - Teil 2: Passive Wassertrogsperren

Protection contre l'explosion dans les mines souterraines - Systemes de protection - Partie 2: Arrets-barrages passifs a bacs a l'eau

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Explosion prevention and protection in underground mines - Protective systems - Part 2: Passive water trough barriers

Protection contre l'explosion dans les mines souterraines - Systèmes de protection - Partie 2: Arrêts-barrages passifs à bacs à l'eau

Explosionsschutz in untertägigen Bergwerken - Schutzsysteme - Teil 2: Passive Wassertrogsperren

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Contents

Page

Figures

Tables

Foreword

This document (EN 14591-2:2007) has been prepared by Technical Committee CEN/TC 305 “Potentially explosive atmospheres - Explosion prevention and protection”, the secretariat of which is held by DIN.

This document shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by September 2007, and conflicting national standards shall be withdrawn at the latest by September 2007.

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.

EN 14591 *Explosion prevention and protection in underground mines — Protective systems* consists of the following parts:

Part 1: 2-bar-explosion-proof ventilation structure

Part 2: Water trough barriers

Part 4: Automatic extinguishing systems for road headers

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, 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 the United Kingdom.

Introduction

Water trough barriers are autonomous protective systems by reducing the effects of combustible dust and/or firedamp explosions in underground mines to a sufficient level of safety. They are used for preventing the propagation of explosions in roadways in underground coal mines. The purpose of water trough barriers is to extinguish explosion flames in roadways in underground mines and in this way to limit propagation of explosions.

Water trough barriers are designed and arranged in such a way that explosions are prevented from spreading through dangerous chain reactions and incipient explosions do not become detonations.

Water trough barriers will only be effective as a configuration of individual water troughs in accurately defined arrangements. Water troughs are the components for this protective system.

Their effectiveness in the event of explosions is based on the distribution of water acting as a fire-extinguishing medium held in individual water troughs, with the blast wave preceding an explosion destroying individual water troughs, thus evenly distributing water, the extinguishing medium, throughout the cross-section of a roadway and extinguishing the explosion flame that follows.

The water trough barriers described in this standard are the result of research and testing of many years above ground and underground. The results of these tests can be used as a basis for type examination.

1 Scope

This standard specifies the requirements for concentrated and distributed passive water trough barriers, and quick-deploy water trough barriers.

This standard specifies the requirements and test methods for water troughs which are used as components of the "water trough barrier" protective system for underground coal mines.

This standard does not apply to active water trough barriers.

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

EN ISO 4589-2, *Plastics — Determination of burning behaviour by oxygen index — Part 2: Ambient-temperature test*

ISO 554, *Standard atmospheres for conditioning and/or testing — Specifications*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1
explosion barrier
device intended effectively to suppress coal-dust and firedamp explosions and to limit their physical impact

3.2
water trough barrier
explosion barrier in which the extinguishing medium, namely water, is contained in water troughs

3.3
water trough
container to hold the extinguishing medium, namely water, together with matching cover

3.4
trough group
any troughs located within a roadway section of no more than 3 m in length in the distributed barrier

NOTE See Figure 1. A group can be composed of 1 to 3 rows of troughs.

3.5
roadway cross-section
area bounded by the roadway floor and lagging or, where no lagging is installed, by the surrounding rock

3.6
volume of roadway section
product of the mean roadway cross-section and relevant length

NOTE In the case of concentrated water trough barriers, the relevant length is the distance between the start and the end of the water trough barrier. In the case of distributed water trough barriers, the relevant length is the distance between two adjacent trough groups.

3.7
passive water trough barrier
fixed or mobile water trough barrier in which the extinguishing medium, namely water, is dispersed solely by the blast pressure of the explosion

3.8
active water trough barrier
fixed or mobile water trough barrier in which the extinguishing medium, namely water, is dispersed independently of the blast pressure of the explosion

3.9
concentrated water trough barrier
water trough barrier which contains a minimum of 200 l of water per square metre of roadway cross-section and which has a length of at least 20 m

NOTE The concentrated water trough barrier contains a minimum of 5 l of water per cubic metre of roadway section between the start and the end of the water trough barrier.

3.10
distributed water trough barrier
water trough barrier which contains a minimum of 1 l of water per cubic metre of roadway section in each trough group measured up to the adjacent trough group

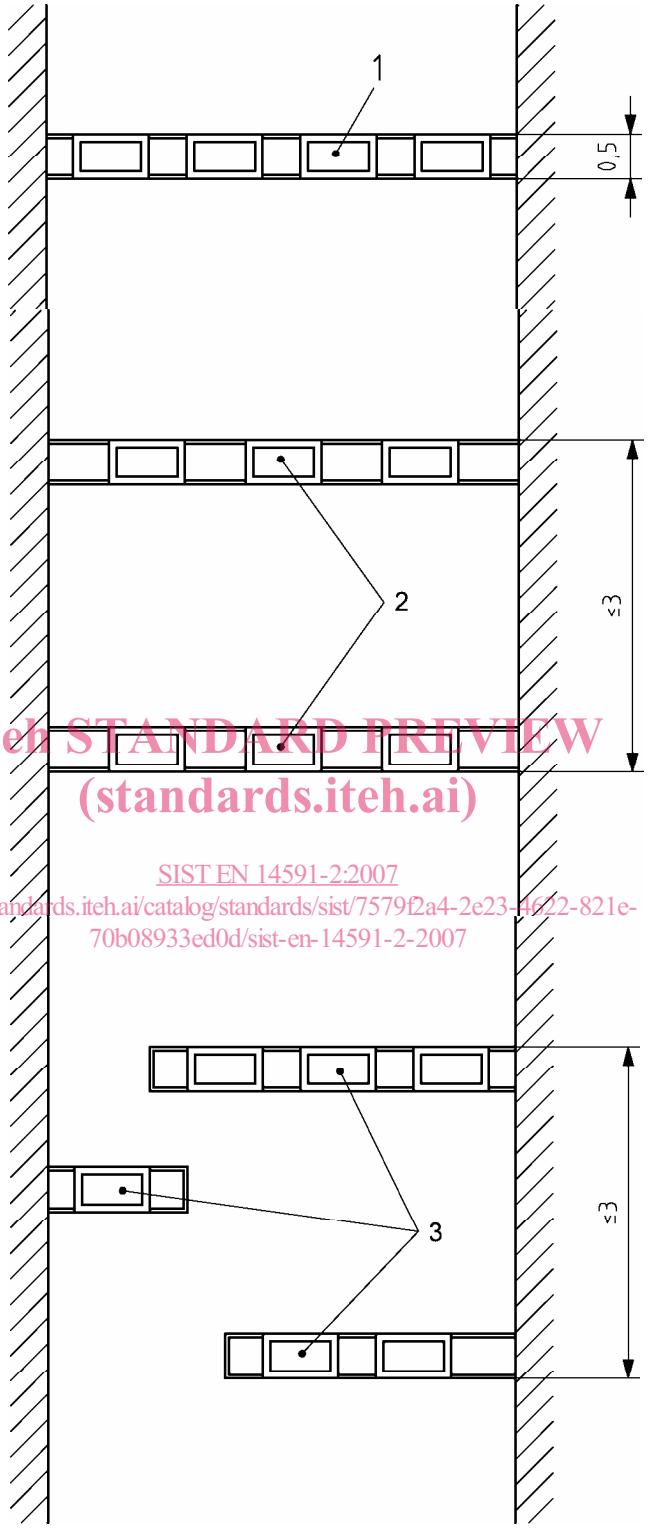
NOTE The clear interval between adjacent trough groups does not exceed 30 m (or 50 m in case of cross-sections up to 10 m^2).

3.11
quick-deploy water trough barrier
quick-deploy water trough barriers are used in the case of rescue action, when concentrated or distributed water trough barriers are not provided between areas where the rescue teams are working and the potential fire source

NOTE Quick-deploy water trough barriers contain at least 60 l of water per square metre of roadway cross-section.

3.12
blast pressure
pressure exerted by a current of air on a free-standing static plate positioned at right angles to the direction of flow

Dimensions in metres



Key

1 Trough group of one trough row
2 Trough group of two trough rows
3 Trough group of three trough rows

Figure 1 — Trough group, plan view

4 Construction requirements of water troughs

4.1 General

This component shall be designed and constructed according to good engineering practice. To ensure avoidance of any ignition source, it shall be subjected to a formally documented hazard analysis.

Water troughs shall be designed so that, in the event of an explosion, the extinguishing medium they contain, namely water, is released in such a way as to produce an effective quenching action.

Water troughs shall be designed so that an adequate dispersion of water is ensured during defined explosion tests with given blast pressures.

Water troughs shall be designed or arranged so that it is possible at any time, without removing the covers, to check whether the level of water in the containers is below the minimum level.

Water troughs shall be of sufficient strength and stability of shape.

Water troughs shall remain functional for as long as possible under the effect of high temperatures.

Water troughs shall be made of plastic.

Water troughs shall be composed of a material which does not burn spontaneously when subjected to a defined level of exposure to flames.

Water troughs shall be designed so that the rate of evaporation of the extinguishing medium, namely water, is as low as possible.

4.2 Dimensions, specifications

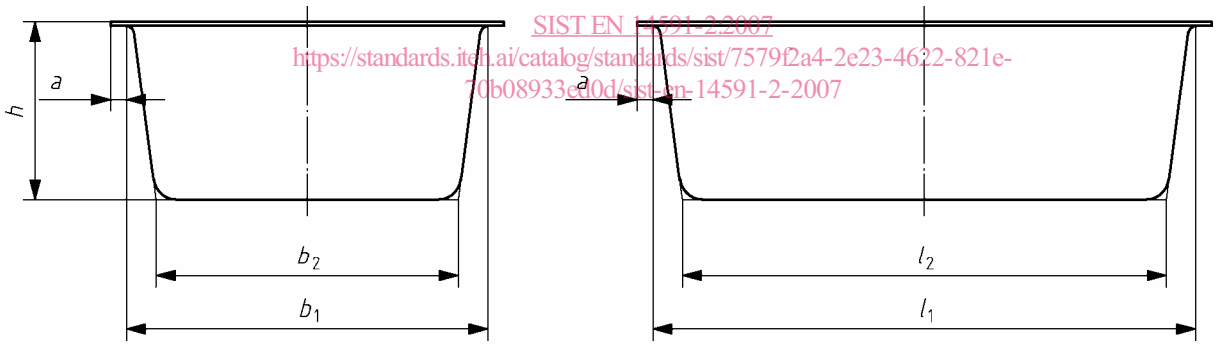


Figure 2 — Water trough type A (side elevations)

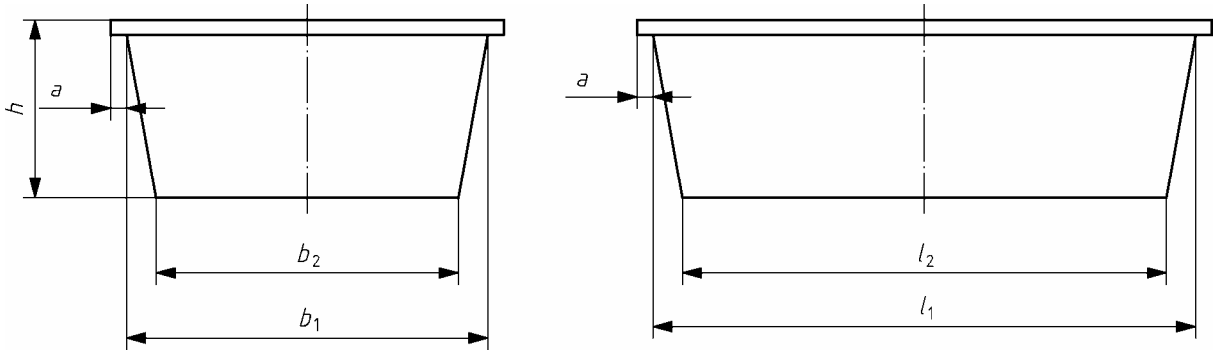


Figure 3 — Water trough type B (side elevations)

Table 1 — Maximum container dimensions and water content for 40 litre water troughs

Water trough type	Container dimensions – max. mm						Capacity l
	a	b_1	b_2	*h*	l_1	l_2	
Type A	59	465	270	300	750	525	40 ± 2
Type B	22	320	231,5	330	625,5	556,5	40 ± 2

Table 2 — Container dimensions and water content for 90 litre water troughs

Water trough type	Container dimensions mm						Capacity l
	a	b_1	b_2	*h*	l_1	l_2	
Type A	25 ± 2	500 ± 2,5	> 415	275 ± 5	760 ± 5	> 675	90 ± 4,5
Type B	20 ± 2	500 ± 2,5	> 415	320 ± 5	760 ± 5	> 675	90 ± 4,5

The covers shall be designed to give a flush fit with the outer rim of the containers.

5 Testing of water troughs

5.1 General

The test pieces for the tests described below comprise one or several water troughs which shall come from the same production run. The number of test pieces required is determined by the respective testing station. When issuing contracts for testing, each testing station shall be provided not only with descriptions and drawings of the equipment (e.g. containers, covers, floats and lid holders), but also with precise data on the composition of the material used. For an example of acceptable test procedures, see Annex B.

NOTE Other test procedures are under consideration.

5.2 Construction tests

5.2.1 Shape, capacity, dimensions

The specifications laid down in 4.2 shall be used as a basis for testing the shape, dimensions and capacity of the water troughs.

5.2.2 Strength, shape retention

When a uniform static load is applied to a stack of water troughs, composed of five containers fitted one inside the other, by a force of 500 N (direction of force at right angles to the container bottoms), the containers shall not suffer damage or permanent deformation. During subsequent unstacking, the containers shall not be wedged together and shall not be damaged.

5.2.3 Water level indicator

The minimum water level indicator shall be checked for correct operation and accuracy. The maximum margin of indicator error shall be ± 5 %.

5.3 Testing of electrostatic properties

5.3.1 Test method

The surface resistance shall be tested in accordance with EN 13463-1.

The test voltage shall be 100 V. The measured value shall be read 60 s after the test voltage has been applied. The measurement shall be carried out in standard atmosphere 23/50-2 according to ISO 554.

5.3.2 Assessment

Containers and matching covers, together with all attachments, shall be fitted together in a conductive manner. Conduction shall take place both externally and internally. The water trough being tested meets the requirements when the surface resistance R_{oA} is less than 10^9 Ω.

6 Additional fittings for water troughs

Water troughs may be provided with additional fittings, such as level indicators and filling and draining devices. These additional fittings shall not conflict with the construction requirements laid down in clause 4.

7 Marking of water troughs

Water troughs (containers and covers) shall be marked. An example is given in Annex C.

8 Construction of concentrated and distributed water trough barriers

8.1 General

The task of a passive water trough barrier is to fill all the roadway cross-section with water if it is exposed to the explosion blast pressure wave.

Water trough barriers comprise troughs which are filled with water (and, if applicable, a permissible additive) and arranged in trough groups. Trough groups are usually formed by special framework structures, shelves or by arranging the troughs on the floor or on appropriate fixtures. These water trough barriers are designated as fixed passive water trough barriers.

Water trough barriers will only be effective for extinguishing a fire subject to being arranged as specified in 8.3 and 8.4.

8.2 Framework structures

Framework structures shall be capable of supporting the applied load. Each structure normally comprises two beams or one shelf arranged at right angles to the roadway axis and a number of cross-pieces set at right angles to the beams.

The framework structures, beams or shelves shall be attached to the supports or to the roadway fixtures by means of suitable mountings. Chains, steel ropes or suspension rods can also be used for this purpose.

The framework structures shall be designed in such a way that suspended troughs can be supported on all sides by the full width of their edges, or failing that at least by the full width of their long sides, or that the troughs can be constructed where necessary using battens.

8.3 Arrangement of troughs in the roadway cross-section

The number of water troughs in a trough group shall be sufficient to comply with 3.9 and 3.10.

The trough groups shall cover the greatest width of the roadway cross-section (floor width or roadway diameter) at the point of installation. The achieved coverage is as follows:

— at least 35 % for roadway cross-sections of up to 10 m^2

— at least 50 % for roadway cross-sections of up to 15 m^2

— at least 60 % for roadway cross-sections of over 15 m^2.

This calculation is based on measurements taken between the edges of the outer troughs of the trough group at the sides of the roadway.

The horizontal distance measured at right angles to the roadway direction

— between the roadway wall and the nearest trough shall not exceed 1,2 m and

— between two troughs shall not exceed 1,5 m.

The total distances shall not exceed 1,8 m.

The vertical distance between the bottom of any trough and the boundary of the roadway cross-section shall not exceed 2,6 m in a downward direction nor 2,0 m in an upward direction. If the distance measured in an upward direction from a trough has to be greater than 2,0 m, an additional trough shall be installed. In this case, the vertical distance between the bottoms of the troughs in each row shall be less than 2,0 m.

Troughs are normally installed with their long sides at right angles to the roadway direction (transverse arrangement). As a deviation from this, individual troughs can be arranged longitudinally (longitudinal arrangement), though the number shall not exceed half of all the troughs in the group where this is necessary in order to provide cover for the roadway width and to reduce the intermediate spaces.

It is permitted to arrange more than 50 % of the troughs in the longitudinal direction if the extinguishing effectiveness is proved by experiments.

Troughs shall be arranged so that they are not obscured by supports or by roadway fixtures. Troughs which are spaced less than 1,2 m apart in the direction of the roadway shall not obscure one another.

Troughs which are arranged at a distance of < 0,5 m above other troughs shall not obscure more than half the lid area of any trough located beneath them.

8.4 Configuration of water trough barriers in mine workings

The distance between the water trough barriers and the intersections or junctions shall be kept as small as possible and shall not exceed 75 m in the case of concentrated water trough barriers and 30 m in the case of distributed water trough barriers.

The maximum distances of 75 m and 30 m between intersections and junctions do not apply when there are no distances greater than 200 m between adjacent concentrated water trough barriers designed to cordon off the intersection and junction areas.

The distance requirements do not apply either between closely-spaced intersections and junctions provided that in any circumstance which may arise the distance between a distributed water trough barrier and an adjacent distributed or concentrated water trough barrier designed to cordon off the intersection and junction areas does not exceed 120 m. In this zone, the erection of water trough barriers can be dispensed with. This means that points where roadways intersect with surface shafts, shaft insets or staple shafts are treated as