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Explosion prevention and protection in underground mines - Equipment and protective systems for firedamp drainage

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Explosionsschutz in untertägigen Bergwerken - Geräte und Schutzsysteme zur Absaugung von Grubengas

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Contents

Page

Foreword

This document prEN 14983 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 is currently submitted to the CEN Enquiry.

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.

Annexes A and B are normative

Introduction

Firedamp drainage is a technical process for selected gas removal, the purpose of which is to reduce the risks presented by inflammable gas and air mixtures. Firedamp drainage is therefore a constructive measure for preventive explosion protection.

In the mining industry, firedamp is drained from the underground workings of gassy mines to ensure that mine workers are not exposed to the risks associated with the occurrence of an explosive atmosphere at their place of work. In this case, the explosion risk results from unacceptable accumulations of firedamp occurring in the waste areas and cavities left in the in the rock strata after the coal has been extracted from the coal seam. In such cases, the need to drain these accumulations, and the complexity of the drainage system, depends on the amount of firedamp produced by the coal and the likelihood of it occurring in explosive quantities in the mine roadways and coal face. Examples of situations that might cause firedamp to move in dangerous concentrations from the waste area or cavities into the mine roadways: a breakdown of the mine ventilation system or a sudden reduction in the underground atmospheric pressure. National legislation in EU coal mining member countries requires workers to be withdrawn to a safe place if firedamp levels attain a specific nationally defined value in the general body of mine air. Firedamp drainage is therefore often used in gassy mines in an attempt to ensure that the concentration of firedamp in the general body of mine air is kept well below this critical level, even during abnormal situations such as those described above.

Once the accumulations of firedamp have been drained from the affected areas, it is usually discharged into the mine return air ventilation shaft (from an open ended pipe) or brought to the mine surface. In systems where the firedamp is brought to the mine surface, it is discharged to the atmosphere through an earthed metallic discharge stack (chimney) or pressurized and delivered to a utilisation system. such as a gas -fired boiler.

In abandoned mines, firedamp drainage is usually used to protect workers at an adjacent nearby mine or to allow it to be utilized, for example by burning it in a gas-fired boiler to produce heat or to generate electricity.

1 Scope

This standard specifies the requirements for equipment and protective systems for firedamp drainage in mines. It also contains requirements for the construction and monitoring of this equipment and protective systems (see EN 1127-2).

2 Normative references

The following documents referred to are required for the application of this document. For dated references, only the edition referred to applies. For undated references the latest edition of the document referred to applies (including amendments).

EN 764, *Pressure equipment - Terminology and symbols - Pressure, temperature, volume*.

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

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

EN 1333, *Pipework components - Definition and selection of PN.*

EN 12874, *Flame arresters – Performance requirements, test methods and limits for use.*

prEN 61024-1, *Protection of structures against fire, explosion and life hazards.*

EN 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems.*

3 Terms and definitions

For the purposes of this European Standard, the terms and definitions given in EN 1127-2 and the following apply:

3.1
leakage resistance
electrical resistance measured between an electrode which is applied to the object and earth

3.2
starting by-pass
temporary and specific by-passing of a safety disconnection when starting the pressure generator of a firedamp drainage plant

3.3
design pressure p_d
maximum pressure in each pressure chamber of the pressure equipment which is used for determining the design pressure of each component. [EN 764]

3.4
extinguishing barrier
device for preventing the propagation of an explosion, consisting of sensors for flame recognition and containers filled with an extinguishing medium for fire control

3.5
technically leaktight
technical leaktightness is achieved when gas pipes, items of plant and equipment, including all detachable and non-detachable connections, are made in such a way that no changes in gas composition occur. The term “technically leaktight” means that diffusion through statically stressed seals can occur

3.6
t_{90}-path
(flow) path which is covered by the measured gas/air mixture, taking account of the velocity of flow, the closing time of the rapid shut-off device and the maximum time lag (t_{90}-time) of the measurement system, including the tripping time. The t_{90}-time relates to the attainment of 90% of the measured concentration change

3.7
permissible pressure p_s
limit value for the operating pressure, normally the maximum pressure of each pressure chamber laid down for safety reasons [EN 764].

4 Equipment and protective systems for firedamp drainage

4.1 General

In the mining industry, firedamp is drained from boreholes and abandoned mine workings.

As the firedamp drainage systems used for all of the above situations contain electrical equipment, mechanical equipment and associated interconnected pipework, it is important that the system itself does not pose an explosion risk. For this reason:

— the equipment used in the firedamp drainage system shall be explosion protected to either category M1 or M2;

— where measuring equipment is in direct contact with firedamp/air concentration within the explosive range (e.g. the purity measuring instruments), it shall be category M1 ignition protected. In surface installations, Group II, Category 1 equipment may be used;

— the drainage system shall be shut down (usually automatically) if the concentration of the extracted firedamp in the pipework becomes explosive or approaches a prescribed limit where it will become explosive.

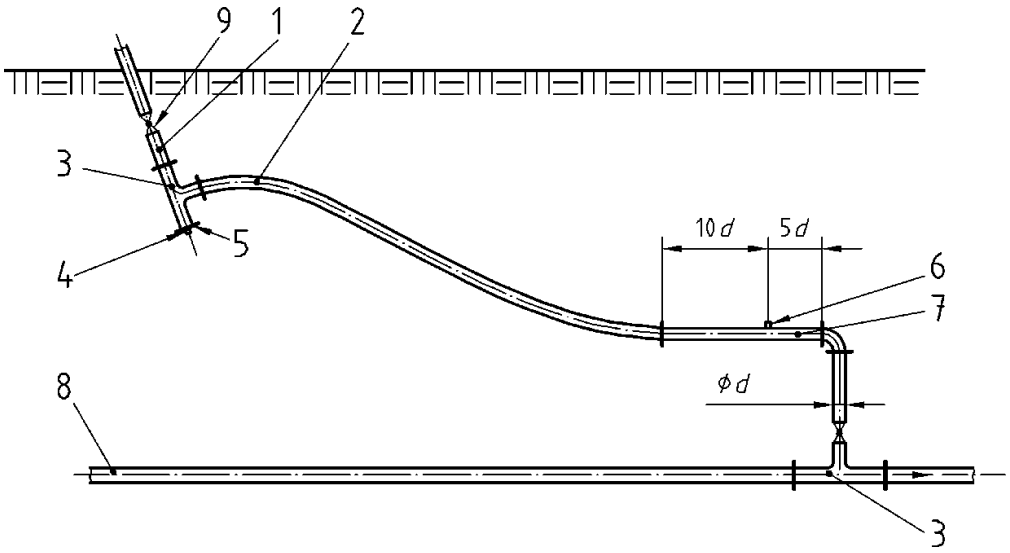
NOTE 1 Care is needed during start-up the firedamp drainage system when the pipework will be full of air and will at some stage pass through the explosive range.

NOTE 2 The explosive range for firedamp/air mixtures is generally accepted as being within the range of about 5% to 15% by volume. Automatic shut down usually takes place if the extracted concentration (purity) falls to a level of about 25% for systems vented to atmosphere and 30 % to 40 % purity for systems utilizing the firedamp in gas-fired boilers (see A.3).

4.2 Borehole standpipes

Standpipes shall be made in such a way that devices (Y- or T-pieces) for the insertion of borehole probes can be attached to them.

The standpipe is to be connected to the firedamp collector pipe by a flexible hose with shut-off device. The connection shall be made in such a way and arranged so that no reduction in cross-section can occur and should contain a suitable device for measuring the volume flow and vacuum pressure where the boreholes will be accessible for measuring and taking firedamp samples, e.g. a metering section (see Figures 1 and 2).



Key

d Diameter

1 Borehole standpipe

2 Hose suitable for the required flow

3 T-piece

4 Connection for water separator

5 Socket for measurements

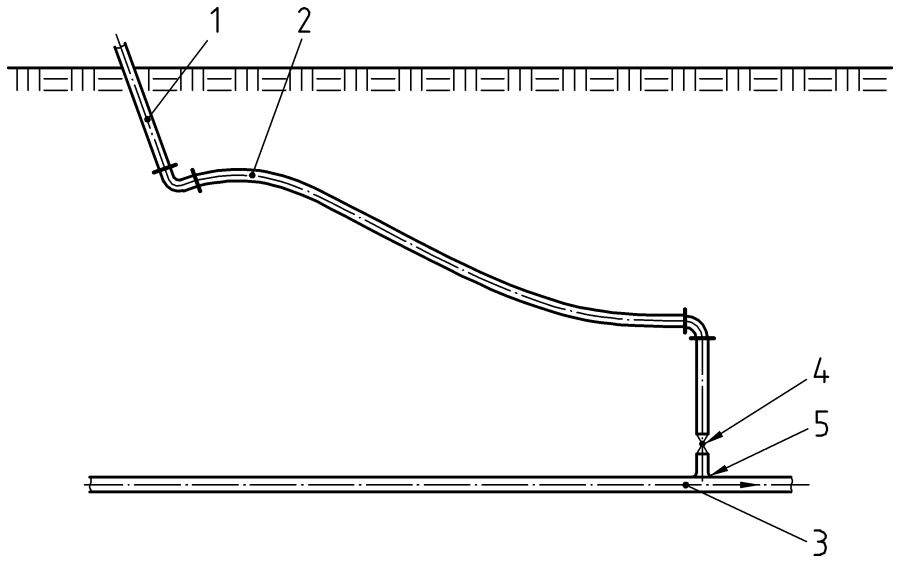
6 Socket for measurements

7 Metering section

8 Collector pipe

9 Valve

Figure 1a – Example of connection of roof borehole to collector pipe when measurement and control is attainable



Key

1 Borehole standpipe

2 Hose suitable for the required flow

3 Collector pipe

4 Valve

5 Suitable connection for collector pipe

Figure 1b – Example of connection of roof borehole to collector pipe when measurement and control is not attainable