Draft for Public Comment

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Interested committees:

Title: Draft BS EN 1918-4 BS Gas infrastructure - Underground gas storage. Part 4: Functional recommendations for storage in rock caverns.

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Introduction

This draft standard is based on national and international discussions. Your comments on this draft are invited and will assist in the preparation of the consequent standard.

For international standards, comments will be reviewed by the relevant UK national committee before sending the consensus UK vote and comments to the international committee, which will then decide appropriate action. If the international standard is approved, it is usual for the text to be published as a British Standard.

For national standards, comments will be reviewed by the relevant UK national committee and the resulting standards published as a British Standard.

UK Vote

Please indicate whether you consider the UK should submit a negative (with supporting technical reasons) or positive vote on this draft. Please indicate if you are aware of any reason why this draft standard should not be published as a British Standard.

Submission of Comments

- **Annotated drafts are not acceptable and will be rejected.**
- All comments should be submitted online at **https://standardsdevelopment.bsigroup.com/**. You will need to register in order to comment.

Template for comments and secretariat observations

Date: xx/xx/20xx	Document: ISO/DIS xxxx

1	2	(3)	4	5	(6)	7
MB	Clause No./ Subclause No./Annex **(e.g. 3.1)**	Paragraph/ Figure/Table/Note	**Type of comment**	**Commend (justification for change) by the MB**	**Proposed change by the MB**	**Secretariat observations on each comment submitted**
	3.1	Definition 1	ed	Definition is ambiguous and needs clarifying.	Amend to read '...so that the mains connector to which no connection...'	
	6.4	Paragraph 2	te	The use of the UV photometer as an alternative cannot be supported as serious problems have been encountered in its use in the UK.	Delete reference to UV photometer.	

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EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

DRAFT
prEN 1918-4

May 2025

ICS 75.200

Will supersede EN 1918-4:2016

English Version

Gas infrastructure - Underground gas storage - Part 4: Functional recommendations for storage in rock caverns

Infrastructures gazières - Stockage souterrain de gaz - Partie 4 : Recommandations fonctionnelles pour le stockage en cavités minées

Gasinfrastruktur - Untertagespeicherung von Gas - Teil 4: Funktionale Empfehlungen für die Speicherung in Felskavernen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 234.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

This draft European Standard was established by CEN in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Warning : This document is not a European Standard. It is distributed for review and comments. It is subject to change without notice and shall not be referred to as a European Standard.

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European foreword

This document (prEN 1918-4:2025) has been prepared by Technical Committee CEN/TC 234 “Gas infrastructure”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 1918-4:2016.

For a list of significant technical changes with respect to EN 1918-4:2016, see Annex A.

This document has been prepared under a standardization request addressed to CEN by the European Commission. The Standing Committee of the EFTA States subsequently approves these requests for its Member States.

This document is Part 4 of a European Standard on “Gas infrastructure - Underground gas storage” which includes the following five parts:

— *Part 1: Functional recommendations for storage in aquifers;*

— *Part 2: Functional recommendations for storage in oil and gas fields;*

— *Part 3: Functional recommendations for storage in solution-mined salt cavities;*

— *Part 4: Functional recommendations for storage in rock caverns;*

— *Part 5: Functional recommendations for surface facilities.*

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Introduction

This document specifies common basic principles for underground gas storage facilities. Users of this document are expected to be aware that more detailed standards and/or codes of practice exist. This document is intended to be applied in association with these national standards and/or codes of practice and does not replace them. Furthermore, a non-exhaustive list of related European and international standards can be found in the Bibliography.

NOTE Directive 2009/73/EC concerning common rules for the internal market in natural gas and the related Regulation (EC) No 715/2009 on conditions for access to the natural gas transmission networks also aim at technical safety including technical reliability of the European gas system. These aspects are also in the scope of CEN/TC 234 standardization. In this respect, CEN/TC 234 evaluated the indicated EU legislation and amended this technical standard accordingly, where required and appropriate.

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1 Scope

This document covers the functional recommendations for design, construction, testing, commissioning, operation, maintenance and abandonment of underground gas storage (UGS) facilities in mined rock caverns up to and including the wellhead.

This document specifies practices which are safe and environmentally acceptable.

For necessary surface facilities for underground gas storage, EN 1918-5 applies.

In this context, "gas" refers to flammable gas:

- which is in a gaseous state at a temperature of 15 °C and under a pressure of 0,1 MPa (the stored product is also named fluid);
- which meets specific quality requirements in order to maintain underground storage integrity, performance, environmental compatibility and fulfils contractual requirements.

This comprises:

- gas not in liquid phase under subsurface conditions;
  - methane-rich gases;
    - natural gas;
    - biomethane;
    - synthetic methane;
  - hydrogen of various purities;
  - any mixtures of the gases above;
- hydrocarbon gas in liquid phase under subsurface conditions such as;
  - ethylene;
  - liquified petroleum gas (LPG).

NOTE 1 Correspondingly the EN 1918 series can be considered where applicable for underground storage of any other fluid e.g. helium, carbon dioxide, compressed air, rDME (renewable dimethyl ether) and hydrogen transport fluids (such as ammonia and LOHC).

Gases that are liquid in subsurface conditions are not considered in this document.

This document is not intended to be applied retrospectively to existing facilities.

NOTE 2 Correspondingly this document can be considered for major conversions in case of significant change of gas composition.

2 Normative references

The following documents in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 1918-5, *Gas infrastructure - Underground gas storage - Part 5: Functional recommendations for surface facilities*

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ISO 1663, *Rigid cellular plastics - Determination of water vapour transmission properties*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. The definitions common to EN 1918 (all parts) are listed in 3.1; those specific for this document are listed in 3.2.

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

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

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

3.1 Terms and definitions common to EN 1918 (all parts)

3.1.1
abandoned well
well permanently out of operation and permanently plugged including removed surface facilities

3.1.2
annulus
space between two strings of pipes or between the casing and the borehole

3.1.3
aquifer
reservoir, group of reservoirs, or a part thereof that is fully water-bearing and displaying differing permeability/porosity

3.1.4
auxiliary well
well completed for other purposes than gas injection/withdrawal, e.g. water disposal

3.1.5
casing
pipe or set of pipes that are screwed or welded together to form a string which is placed in the borehole for the purpose of supporting the borehole and to act as a barrier preventing subsurface migration of fluids when the annulus between it and the borehole has been cemented and to connect the storage reservoir respectively cavern to surface

3.1.6
casing shoe
bottom end of a casing

3.1.7
cementing
operation whereby usually a cement slurry is pumped and circulated down a cementation string within the casing and then upwards into the annulus between the casing and the open or cased hole

3.1.8
completion
technical equipment inside the last cemented casing of a well

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3.1.9
containment
capability of the storage reservoir or cavern and the storage wells to resist leakage or migration of the fluids contained therein

Note 1 to entry: This is also known as the integrity of a storage facility.

3.1.10
core sample
sample of rock taken during coring operation in order, e.g. to determine various parameters by laboratory testing and/or for a geological description

3.1.11
cushion gas volume
gas volume required in a storage for reservoir management purpose and to maintain an adequate minimum storage pressure for meeting working gas volume delivery with a required withdrawal profile and in addition in caverns also for stability reasons

Note 1 to entry: The cushion gas volume of storages in oil and gas fields can consist of recoverable and non-recoverable *in situ* gas volumes and/or injected gas volumes.

3.1.12
drilling
all technical activities connected with the construction of a well

3.1.13
exploration
all technical activities connected with the investigation of potential storage locations for the assessment of storage feasibility and derivation of design parameters

3.1.14
formation (horizon)
body of rock mass characterized by a degree of homogeneous lithology which forms an identifiable geologic unit

3.1.15
gas injection
gas delivery from gas transport system into the reservoir/cavern through surface facilities and wells

3.1.16
gas inventory
total of working and cushion gas volumes contained in UGS

3.1.17
gas withdrawal
gas delivery from the reservoir / cavern through wells and surface facilities to gas transport system

3.1.18
geological modelling
generating the image of a structure from the information gathered

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3.1.19
hydrogen
H
lightest and most represented chemical element, found in nature as a diatomic molecule (H2, or dihydrogen), gaseous under standard conditions, colourless, odourless and highly flammable

3.1.20
indicator horizon
horizon overlying the caprock in the storage area and used for monitoring

3.1.21
landing nipple
device in a tubing string with an internal profile to provide for latching and sealing various types of plugs or valves

3.1.22
liner
casing installed within last cemented casing in the lowermost section of the well without extension to surface

3.1.23
lithology
characteristics of rocks based on description of colour, rock fabrics, mineral composition, grain characteristics, and crystallization

3.1.24
logging
measurement of physical parameters versus depth in a well

3.1.25
master valve
valve at the wellhead designed to close off the well for operational reasons and in case of emergency or maintenance

3.1.26
maximum operating pressure
MOP
maximum pressure of the storage reservoir or cavern, normally at maximum inventory of gas in storage, which has not to be exceeded in order to ensure the integrity of the UGS and is based on the outcome of geological/technical engineering and is approved by authorities

Note 1 to entry: The maximum operating pressure is related to a datum depth and in caverns usually to the casing shoe of the last cemented casing.

3.1.27
minimum operating pressure
minimum pressure of the storage reservoir or cavern, normally reached at the end of the decline phase of the withdrawal profile and is for caverns based on geomechanical investigations to ensure stability and limit the effect of subsidence

Note 1 to entry: The minimum pressure is related to a datum depth.

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3.1.28
monitoring well
observation well
well for purposes of monitoring the storage horizon and/or overlying or underlying horizons for subsurface phenomena such as pressure fluctuation, fluid flow and qualities, temperature, etc

3.1.29
operating well
well used for gas withdrawal and/or injection

3.1.30
overburden
all sediments or rock that overlie a geological formation

3.1.31
permeability
capacity of a rock to allow fluids to flow through its pores

Note 1 to entry: Permeability is usually expressed in Darcy. In the SI Unit system permeability is measured in m^2.

3.1.32
plug
tool designed to isolate different zones within a well, usually set to prevent fluid migration, especially for well abandonment operations

3.1.33
porosity
volume of the pore space (voids) within a rock formation expressed as a percentage of its total volume

3.1.34
reservoir
porous and permeable (in some cases naturally fractured) formation having area- and depth-related boundaries based on physical and geological factors

Note 1 to entry: It contains fluids which are internally in pressure communication.

3.1.35
saturation
percentages of pore space occupied by fluids

3.1.36
seismic technology
technology to characterize the subsurface image with respect to extent, geometry, fault pattern and fluid content applying acoustic waves, impressed by sources near to surface in the subsurface strata, which pass through strata with different seismic responses and filtering effects back to surface where they are recorded and analysed

3.1.37
string
entity of casing or tubing plus additional equipment, screwed or welded together as parts of a well respectively completion

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3.1.38
subsurface safety valve
valve installed in casing and/or tubing beneath the wellhead or the lower end of the tubing for the purpose of stopping the flow of gas in case of emergency

3.1.39
tubing
pipe or set of pipes that are screwed or welded together to form a string, through which fluids are injected or withdrawn or which can be used for monitoring

3.1.40
well
borehole and its technical equipment including the wellhead

3.1.41
well integrity
well condition without uncontrolled release of fluids throughout the life cycle

3.1.42
well integrity management
complete system necessary to ensure well integrity at all times throughout the life cycle of the well, which comprises dedicated personnel, assets, including subsurface and surface installations, and processes provided by the operator to monitor and assess well integrity

3.1.43
wellhead
equipment supported by the top of the casing including tubing hanger, shut off and flow valves, flanges and auxiliary equipment, which provides the control and closing-off of the well at the upper end of the well at the surface

3.1.44
working gas volume
volume of gas in the storage above the designed level of cushion gas volume, which can be withdrawn/injected with installed subsurface and surface facilities (wells, flow lines, etc.) subject to legal and technical limitations (pressures, gas velocities, flowrates, etc.)

Note 1 to entry: Depending on local site conditions (injection/withdrawal rates, utilization hours, etc.) the working gas volume can be cycled more than once a year.

3.1.45
workover
well intervention to restore, increase production, repair or change the completion of a well or the leaching equipment of a cavern

3.2 Terms and definitions specific to this document

3.2.1
capillary threshold pressure
pressure needed to overcome the property of a porous rock saturated with a wetting phase (water) to block the flow of a non-wetting phase (gas)

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