BS EN 12126:2012

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Chemicals used for treatment of water intended for human consumption — Liquefied ammonia

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National foreword

This British Standard is the UK implementation of EN 12126:2012. It supersedes BS EN 12126:2005 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 77782 0

ICS 13.060.20; 71.100.80

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 January 2013.

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 12126

November 2012

ICS 71.100.80

Supersedes EN 12126:2005

English Version

Chemicals used for treatment of water intended for human consumption - Liquefied ammonia

Produits chimiques utilisés pour le traitement de l'eau destinée à la consommation humaine - Ammoniac liquéfié

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Ammoniak, flüssig

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Ref. No. EN 12126:2012: E

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Foreword

This document (EN 12126:2012) has been prepared by Technical Committee CEN/TC 164 “Water supply”, the secretariat of which is held by AFNOR.

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of an identical text or by endorsement, at the latest by May 2013, and conflicting national standards shall be withdrawn at the latest by May 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12126:2005.

The significant technical differences between this edition and EN 12126:2005 are as follows:

— Modification of 6.2 on labelling, deletion of the reference to EU Directive 80/778/EEC of 15 July 1980 in order to take account of the latest Directive in force.

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Introduction

In respect of potential adverse effects on the quality of water intended for human consumption caused by the product covered by this European Standard:

a) this European Standard provides no information as to whether the product may be used without restriction in any of the Member States of the EU or EFTA;

b) it should be noted that, while awaiting the adoption of verifiable European criteria, existing national regulations concerning the use and/or the characteristics of this product remain in force.

NOTE Conformity with this European Standard does not confer or imply acceptance or approval of the product in any of the Member States of the EU or EFTA. The use of the product covered by this European Standard is subject to regulation or control by National Authorities.

1 Scope

This European Standard is applicable to liquefied ammonia used for treatment of water intended for human consumption. It describes the characteristics and specifies the requirements of liquefied ammonia and refers to the corresponding analytical methods. It gives information for its use in water treatment. It also determines the rules relating to the safe handling and use of liquefied ammonia (see Annex B).

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 ISO 3696, *Water for analytical laboratory use — Specification and test methods (ISO 3696)*

ISO 7103, *Liquefied anhydrous ammonia for industrial use — Sampling — Taking a laboratory sample*

ISO 7105, *Liquefied anhydrous ammonia for industrial use — Determination of water content — Karl Fischer Method*

ISO 7106, *Liquefied anhydrous ammonia for industrial use — Determination of oil content — Gravimetric and infra-red spectrometric methods*

3 Description

3.1 Identification

3.1.1 Chemical name

Ammonia liquefied, anhydrous.

3.1.2 Synonym or common name

Ammonia.

3.1.3 Relative molecular mass

17,03.

3.1.4 Empirical formula

NH_3.

3.1.5 Chemical formula

NH_3.

3.1.6 CAS Registry Number [1)]

7664-41-7.

1) Chemical Abstracts Service Registry Number.

3.1.7 EINECS reference [2)]

231-635-3.

3.2 Commercial form

The product is available as liquefied gas.

3.3 Physical properties

3.3.1 Appearance and odour

The product is colourless liquid with a characteristic pungent odour.

3.3.2 Density

The density of the gas is 0,771 g/l at 101,3 kPa [3)] and 0 °C.

The density of the liquid is 0,682 g/ml at 101,3 kPa and -34 °C, and 0,61 g/ml at 850 kPa and 20 °C.

3.3.3 Solubility (in water)

The solubility of the product in water is 900 g/l at 0 °C, 520 g/l at 20 °C, and 407 g/l at 30 °C.

3.3.4 Vapour pressure

The vapour pressure of the product is 400 kPa at 0 °C, 850 kPa at 20 °C and 2 035 kPa at 50 °C.

3.3.5 Boiling point at 100 kPa [3)]

The boiling point of the product is -33,4 °C at 101,3 kPa.

3.3.6 Melting point

The melting point of the product is -77,7 °C at 101,3 kPa.

3.3.7 Specific heat

The specific heat of the product is 4,61 kJ/(kg K) at 0 °C and 4,86 kJ/(kg K) at 40 °C.

3.3.8 Viscosity, dynamic

The viscosity of the product is 0,254 mPa.s at 33 °C and 101,3 kPa.

3.3.9 Critical temperature

132,4 °C.

3.3.10 Critical pressure

11 450 kPa.

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2) European Inventory of Existing Commercial Chemical Substances.

3) 100 kPa = 1 bar.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Ammonia reacts violently with halogens, acids, acid halides, acid anhydrides and oxidising agents. It reacts with zinc, copper, tin and their alloys. Mixtures of volume fraction of 15 % to 30 % of ammonia with air are explosive.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for liquefied ammonia used for the treatment of water intended for human consumption. Limits are given for impurities commonly present in the product. Depending on the raw material and the manufacturing process other impurities may be present and, if so, this shall be notified to the user and when necessary to relevant authorities.

Users of this product should check the national regulations in order to clarify whether it is of appropriate purity for treatment of water intended for human consumption, taking into account raw water quality, required dosage, contents of other impurities and additives used in the product not stated in this product standard.

Limits have been given for impurities and chemical parameters where these are likely to be present in significant quantities from the current production process and raw materials. If the production process or raw materials leads to significant quantities of impurities, by-products or additives being present, this shall be notified to the user.

4.2 Composition of commercial product

Liquefied ammonia shall not contain less than a mass fraction of 99,8 % of NH_3.

4.3 Impurities and main by-products

The product shall conform to the requirements specified in Table 1.

Table 1 — Impurities

Impurity		Limit
Water	max	Mass fraction 0,1 %
Permanent gases and methane	max	Volume fraction 0,1 %
Oil	max	5 mg/kg

4.4 Chemical parameters

The chemicals parameters defined in the EU Water Directive (see [1]) are not found in liquefied ammonia. Cyanides, pesticides and polycyclic aromatic hydrocarbons are not by-products of the manufacturing process.

5 Test methods

5.1 Sampling

Follow the sampling method according to ISO 7103.

5.2 Analyses

5.2.1 Main product

The ammonia concentration is calculated by subtracting the contents of the main impurities from mass fraction 100 %.

5.2.2 Impurities

5.2.2.1 Water

The water content shall be determined in accordance with ISO 7105.

5.2.2.2 Oil content

The oil content shall be determined in accordance with ISO 7106.

5.2.3 Permanent gases and methane

5.2.3.1 Principle

The method is a gas chromatographic determination of inert gases and methane in liquid ammonia, determined as a volume fraction.

The content of trace contaminants is determined by gas chromatography according to an external standard method. Metering from the gas pipette is carried out by means of pressure-controlled feed via a fixed-volume sampling valve.

Liquefied ammonia is evaporated prior to the gas chromatographic test in a special steel gas pipette.

5.2.3.2 Reagents and materials

5.2.3.2.1 Reagents

All reagents shall be of a recognised analytical grade and the water used shall conform to the grade 3 specified in EN ISO 3696.

5.2.3.2.2 Carrier gas

Helium, minimum purity volume fraction 99,9 %.

5.2.3.2.3 Calibration gas mixture of the following composition:

— hydrogen volume fraction 91 %;

— nitrogen volume fraction 5 %;

— methane volume fraction 3 %;

— sum of oxygen and argon volume fraction 1 %.

5.2.3.2.4 Material for preparation of the column

Molecular sieve 13 X of particle size 250 µm to 360 µm, or any other equivalent suitable material.

5.2.3.3 Apparatus

5.2.3.3.1 Gas chromatographic apparatus.

Any suitable gas chromatograph, fitted with a thermal conductivity detector, may be used.

5.2.3.3.1.1 Characteristics of the gas chromatographic apparatus:

— Column temperature: typically 40 °C isothermal conditions.

— Detector temperature: typically 130 °C.

— Filament temperature: typically 200 °C.

5.2.3.3.1.2 Carrier gas flow rate

The carrier gas flow rate shall be approximately 25 ml/min. It is usually measured at column outlet and at ambient temperature.

5.2.3.3.2 Injection equipment.

Stainless steel gas sample valve with a loop of 2 ml capacity, operating under the following conditions:

— temperature: ambient to 50 °C;

— pressure: atmospheric.

5.2.3.3.3 Column.

5.2.3.3.3.1 Construction

The column may be made of any suitable material that does not react with the test portion, for example stainless steel. Typical dimensions are as follows:

a) length: according to the test method used but typically 4 m;

b) diameter: internal diameter approximately 3,2 mm; external diameter approximately 6 mm;

c) shape: adapted to the oven geometry. If coiled, the coil diameter shall be at least ten times the outer diameter of the tube.

5.2.3.3.3.2 Packing

5.2.3.3.3.2.1 Composition

Molecular sieve (see 5.2.3.2.4).

5.2.3.3.3.2.2 Method of packing

Use a standardised procedure to give a packed column capable of separating the permanent gas and methane.

5.2.3.3.3.3 Thermal conductivity detector, of such sensitivity that the height of the permanent gas and methane peaks to be measured at the limit of detection is not less than twice the peak-to-noise level.

5.2.3.3.3.4 Recorder

The development of the retention time shall be approximately 10 min.

5.2.3.4 Procedure

5.2.3.4.1 Setting up the chromatograph

Set up the chromatograph as specified in 5.2.3.2 and 5.2.3.3.

5.2.3.4.2 Determination of the area correction factor

Approximately 25 kPa(p) of the calibrating gas is precisely metered into the gas chromatographic system and chromatographied under the conditions specified in 5.2.3.2 and 5.2.3.3. The peak areas are determined and the area correction factors calculated in accordance with 5.2.3.5.1.

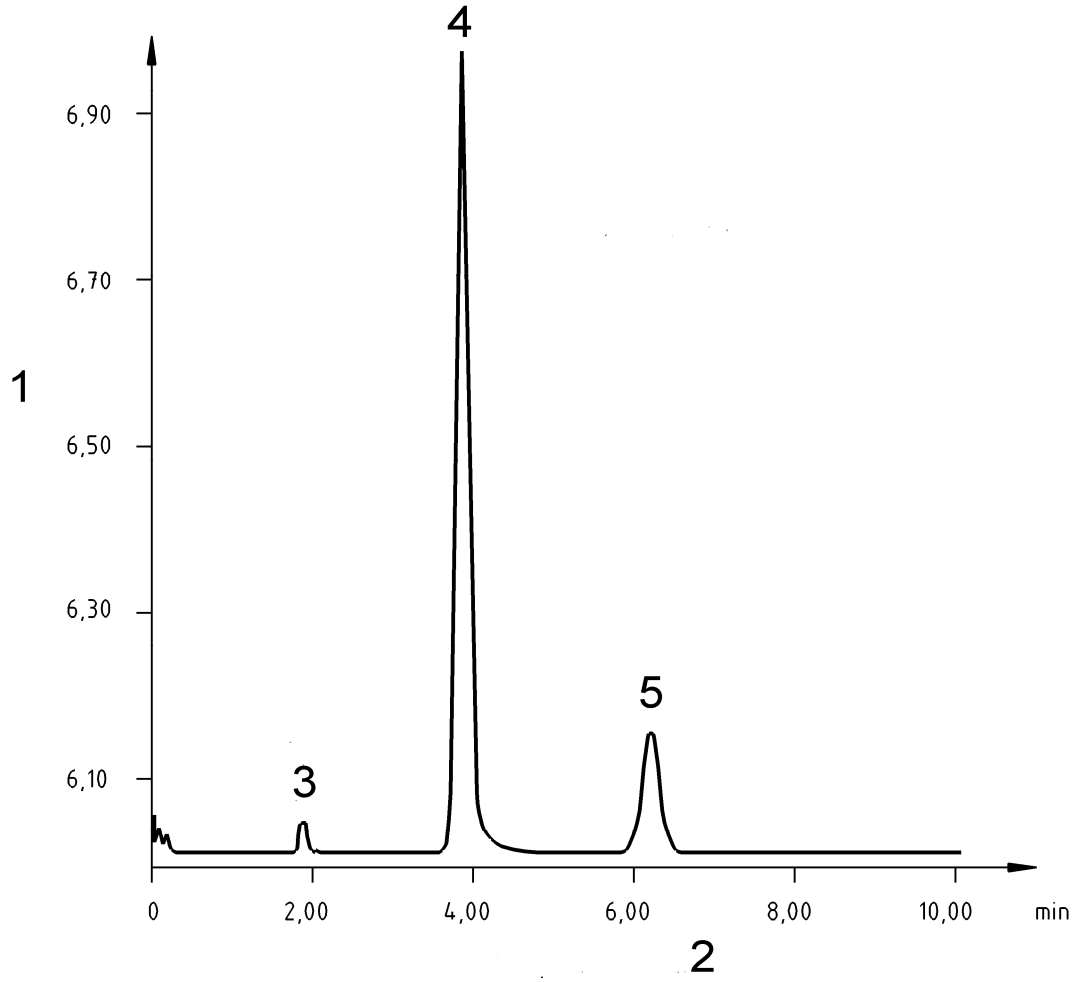
5.2.3.4.3 Determination

To determine methane and inert gases, approximately 90 kPa (p_s) of the gas sample is precisely metered in via a 2 ml sampling valve and chromatographied under the conditions specified in 5.2.3.2 and 5.2.3.3. The peak areas are determined and the volume fraction is calculated in accordance with 5.2.3.5.2.

5.2.3.4.4 Examination of the chromatogram

5.2.3.4.4.1 Typical chromatogram

See Figure 1.



Key

1) amplitude
2) retention time in minutes
3) oxygen
4) nitrogen
5) methane

Figure 1 — Typical chromatogram for liquefied ammonia

5.2.3.4.4.2 Retention time

The retention time is approximately 10 min.

5.2.3.5 Calculations

5.2.3.5.1 Calculation of the area correction factors (f_i)

The area correction factor for oxygen, for nitrogen and for methane (f_i) is calculated by the following formula:

$$f_i = \frac{p \times \varphi_i}{A_i} \quad (1)$$

where

p is the feed pressure in kilopascals;

φ_I is the volume fraction in % of oxygen, nitrogen or methane;

A_i is the area of the peak of oxygen, nitrogen or methane.

5.2.3.5.2 Expression of results

The content of oxygen, nitrogen or methane, expressed as a volume fraction in % is given by the following formula:

$$\varphi_i = \frac{A_i \times f_i}{p_s} \quad (2)$$

where

p_S is the sample feed pressure in kilopascals;

A_i is the area of the peak of oxygen, nitrogen or methane;

f_i is the area correction factor for oxygen, nitrogen or methane.

5.2.3.6 Determination limit, detection limit

The determination limit of the method is a volume fraction of 0,001 0 % and the detection limit is a volume fraction of 0,000 3 %.

6 Labelling – Transportation – Storage

6.1 Means of delivery

The product shall be delivered in suitable pressure containers.

In order that the purity of the product is not affected, the means of delivery shall not have been used previously for any different product or it shall have been specially cleaned and prepared before use.

6.2 Labelling according to the EU legislation [4)]

The following labelling requirements apply to liquefied ammonia at the date of the publication of this European Standard:

Hazard pictograms

GHS 09

GHS 04

GHS 05

GHS 06

4) See [2].

— Signal word: **Danger**

— Hazard statements:

H331: Toxic if inhaled

H221: Flammable gas

H314: Causes severe skin burns and eye damage

H280: Contains gas under pressure; may explode if heated.

H400: Very toxic to aquatic life

EUH071: Corrosive to the respiratory tract

Precautionary statements ("P statements") should be provided by the company being responsible for the marketing of the substance. They should be indicated on the packaging label and in the extended safety data sheet (eSDS) of the substance.

The legislation [2], and its amendments for the purposes of its adaptation to technical and scientific progress, contains a list of substances classified by the EU. Substances not listed in this regulation should be classified on the basis of their intrinsic properties according to the criteria in the regulation by the person responsible for the marketing of the substance.

6.3 Transportation regulations and labelling

Liquefied ammonia is listed as UN Number [5)] N° 1005.

RID [6)]: class 2; classification code 2TC.

ADR [7)]: class 2 ; classification code 2TC.

IMDG [8)]: class 2 label 2.3.

IATA[9)]: class 2 label 2.3.

6.4 Marking

The marking shall include the following:

— the name "liquefied ammonia", trade name and grade;

— the net mass;

— the name and the address of supplier and/or manufacturer;

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5) United Nations Number.

6) Regulations concerning International carriage of Dangerous Goods by Rail.

7) European Agreement concerning the international carriage of Dangerous goods by Road.

8) International Maritime Transport of Dangerous Goods.

9) International Air Transport Association.

— the statement "this product conforms to EN 12126".

6.5 Storage

6.5.1 Long term stability

Decomposition begins at 450 °C. Ammonia does not decompose when stored and handled correctly.

6.5.2 Storage incompatibilities

Containers shall be kept tightly closed in a cool, well-ventilated place and handled with care. Avoid contact with halogens, acid anhydrides, oxidising agents, zinc, copper, tin and their alloys.

Annex A
(informative)

General information on liquefied ammonia

A.1 Origin

A.1.1 Raw materials

Liquefied ammonia is manufactured from nitrogen and hydrogen.

A.1.2 Manufacturing process

Nitrogen and hydrogen are combined to produce ammonia in the "Haber-Bosch process".

A.2 Use

A.2.1 Function

The function of liquefied ammonia in water treatment is bacteriostatic treatment, after reaction with chlorine in water solution to form chloramine.

A.2.2 Form in which it is used

See A 2.4.

A.2.3 Treatment dose

The usual treatment dose of chloramine is 1 mg/l expressed as chlorine, corresponding to 0,3 mg/l expressed as NH_3.

A.2.4 Means of application

Liquefied ammonia is evaporated, then dissolved in water and injected in the water to be treated.

A.2.5 Secondary effects

Increase of pH-value, if excessive amounts are added.

A.2.6 Removal of excess product

Not applicable.

Annex B
(normative)

General rules relating to safety

B.1 Rules for safe handling and use

The supplier shall provide current safety instructions.

B.2 Emergency procedures

B.2.1 First aid

In case of contact with the eyes treat by thorough irrigation with water, with the eyelids held open. Consult a doctor (or eye specialist) immediately.

In case of contact with the skin take off immediately all contaminated clothing and wash with plenty of water. Do not rub frozen parts of the body, instead provide sterilised protective bandage. Seek medical advice immediately.

After inhalation, move for fresh air treatment, keep patient calm and warm. If the patient stops breathing, provide artificial respiration. Seek medical advice immediately.

In case of ingestion, seek medical advice immediately. Do not induce vomiting. If patient is conscious, get him to drink plenty of water (or acetic acid of mass fraction of 1 % to 2 % or lemon juice) immediately. In any case, consult a physician.

B.2.2 Spillage

After spillage/leakage/gas leakage, spray water to trap the gas escaping from containers or arising from leaked product. Do not spray water into liquid ammonia. Cover with ammonia-resistant medium expansion foam and pump into suitable containers under expert supervision. Use the necessary personal protective equipment when handling.

B.2.3 Fire

Extinguishing media: Foam. Do not use water.

Bibliography

[1] 98/83/EC, *Council Directive of 3 November 1998 on the quality of water intended for human consumption.*

[2] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (REACH)

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