BRITISH STANDARD

BS EN
974:2003

Chemicals used for treatment of water intended for human consumption — Phosphoric acid

The European Standard EN 974:2003 has the status of a
British Standard

ICS 71.100.80

National foreword

This British Standard is the official English language version of EN 974:2003. It supersedes BS EN 974:1997 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee CII/59, Chemicals for drinking water treatment, which has the responsibility to:

- aid enquirers to understand the text;
- present to the responsible international/European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;
- monitor related international and European developments and promulgate them in the UK.

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

Additional information

Article 10 of the Council of the European Community Directive 98/83/EC on the quality of water intended for human consumption requires Member States to ensure that substances and materials (including associated impurities) used in the preparation of drinking water do not remain in treated water at concentrations that are higher than necessary or that would reduce the protection of public health provided for in the Directive.

This requirement is given effect in England and Wales by regulation 25 of the Water supply (water quality) regulations 1989 (similar provisions apply in Scotland and Northern Ireland). Regulation 25 makes provision for attaching conditions of use to chemicals and filter media that are authorized for use in public water supplies.

Details of conditions of use are contained in the *List of products and processes approved under regulations 25 and 26 for use in connection with the supply of water for drinking, washing, cooking and food production purposes* published by the Drinking Water Inspectorate, Floor 2/A1, Ashdown House, 123 Victoria Street, London SW1 6DE (www.dwi.gov.uk).

Cross-references

The British Standards which implement international or European publications referred to in this document may be found in the *BSI Catalogue* under the section entitled "International Standards Correspondence Index", or by using the "Search" facility of the *BSI Electronic Catalogue* or of British Standards Online.

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

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 6 February 2004

Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 20, an inside back cover and a back cover.

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Amendments issued since publication

Amd. No.	Date	Comments

ISBN 0 580 43379 X

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 974

October 2003

ICS 71.100.80

Supersedes EN 974:1997

English version

Chemicals used for treatment of water intended for human consumption - Phosphoric acid

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

Produkte zur Aufbereitung von Wasser für den menschlichen Gebrauch - Phosphorsäure

This European Standard was approved by CEN on 12 September 2003.

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. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Management Centre or to any CEN member.

This European Standard exists 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 Management Centre has the same status as the official versions.

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN 974:2003 E

Contents

Foreword

This document EN 974:2003 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 April 2004, and conflicting national standards shall be withdrawn at the latest by April 2004.

This document supersedes EN 974:1997.

Significant technical differences between this standard an EN 974:1997 are as follows:

a) reference to ISO 4285 for sampling and ISO 2997 for determination of content of sulfuric acid;

b) taking into account of new EU Directive 98/83/EC;

c) inclusion of more reliable data in table C.1.

Annexes A and C are informative.

Annex B is normative.

This document includes a Bibliography.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

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

a) this 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 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 phosphoric acid used for treatment of water intended for human consumption. It describes the characteristics and specifies the requirements and the corresponding test methods for phosphoric acid. It gives information on its use in water treatment. It also determines the rules relating to safe handling and use (see annex B).

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN ISO 3696, *Water for analytical laboratory use - Specification and test methods (ISO 3696:1987)*.

ISO 2997, *Phosphoric acid for industrial use - Determination of sulfate content - Method by reduction and titrimetry.*

ISO 3165, *Sampling of chemical products for industrial use - Safety in sampling*.

ISO 3706, *Phosphoric acid for industrial use (including foodstuffs) - Determination of total phosphorus (V) oxide content - Quinoline phosphomolybdate gravimetric method*.

ISO 4285, *Phosphoric acid for industrial use - Guide to sampling techniques.*

ISO 5993, *Sodium hydroxide for industrial use - Determination of mercury content - Flameless atomic absorption spectrometric method*.

ISO 6206, *Chemical products for industrial use - Sampling - Vocabulary*.

ISO 6353-2, *Reagents for chemical analysis - Part 2: Specifications - First series*.

3 Description

3.1 Identification

3.1.1 Chemical name

Phosphoric acid.

3.1.2 Synonym or common name

Orthophosphoric acid.

3.1.3 Relative molecular mass

98.

3.1.4 Empirical formula

H_3PO_4

3.1.5 Chemical formula

H_3PO_4

3.1.6 CAS Registry Number (1)

7664-38-2.

3.1.7 EINECS reference (2)

231-633-2.

3.2 Commercial form

Phosphoric acid is supplied as a concentrated solution.

3.3 Physical properties

3.3.1 Appearance

The product is a clear syrupy liquid.

3.3.2 Density

1,57 g/ml at 20 °C for phosphoric acid concentration of mass fraction of 75 %.

1,69 g/ml at 20 °C for phosphoric acid concentration of mass fraction of 85 %.

3.3.3 Solubility in water

The product is miscible at all concentrations.

3.3.4 Vapour pressure

Below 3 Pa at 20 °C.

3.3.5 Boiling point at 100 kPa (3)

135 °C for phosphoric acid concentration of mass fraction of 75 %.

158 °C for phosphoric acid concentration of mass fraction of 85 %.

3.3.6 Melting point

- 20 °C for phosphoric acid concentration of mass fraction of 75 %.

+ 21 °C for phosphoric acid concentration of mass fraction of 85 %.

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(1) Chemical Abstracts Service Registry Number.

(2) European Inventory of Existing Commercial Chemical Substances.

(3) 100 kPa = 1 bar.

3.3.7 Specific heat

2,27 kJ/kg.K at 20 °C for phosphoric acid concentration of mass fraction of 75 %.

2,07 kJ/kg.K at 20 °C for phosphoric acid concentration of mass fraction of 85 %.

3.3.8 Viscosity dynamic

At room temperature phosphoric acid is a syrupy liquid. Its viscosity depends on temperature.

The viscosity of a mass fraction of 75 % solution of phosphoric acid at 20 °C is 22 mPa.s.

The viscosity of a mass fraction of 85 % solution of phosphoric acid at 20 °C is 48 mPa.s.

3.3.9 Critical temperature

Not applicable.

3.3.10 Critical pressure

Not applicable.

3.3.11 Physical hardness

Not applicable.

3.4 Chemical properties

Phosphoric acid is a strong acid. A solution of 1 g/l phosphoric acid has a pH value of 1. Concentrated phosphoric acid reacts violently with bases, nitrates, chlorates, sulfites.

4 Purity criteria

4.1 General

This European Standard specifies the minimum purity requirements for phosphoric acid 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.

NOTE Users of this product should satisfy themselves that 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 products not stated in the product standard, and other relevant factors.

Limits have been given for impurities and chemicals 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 lead to significant quantities of impurities, by-products or additives being present, this shall be notified to the user.

4.2 Composition of commercial product

The usual commercial concentrations of phosphoric acid have a mass fraction of 75 %, 80 % or 85 %.

If sold as concentrated acid, the phosphoric acid content shall not be less than a mass fraction of 75 %.

The concentration of phosphoric acid shall be within a mass fraction of 1 % of the manufacturer's declared value.

4.3 Chemical parameters and indicator parameters

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

Table 1 — Chemical parameters and indicator parameters

Parameter		Limit in H_3PO_4 (mg/kg)
Sulfuric acid (H_2SO_4)	max	500
Iron (Fe)	max	20
Antimony (Sb)	max	4
Arsenic (As)	max	2
Cadmium (Cd)	max	0,5
Chromium (Cr)	max	4
Lead (Pb)	max	4
Mercury (Hg)	max	0,5
Nickel (Ni)	max	4
Selenium (Se)	max	1

NOTE For parametric values of phosphoric acid on trace metal content in drinking water, see [1].

5 Test methods

5.1 Sampling

Observe the general recommendations in ISO 3165 and take account of ISO 6206.

Prepare the laboratory sample required by the relevant procedure in accordance with ISO 4285.

5.2 Analyses

5.2.1 General

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

5.2.2 Phosphoric acid (main product)

The concentration of phosphoric acid (H_3PO_4) shall be determined in accordance with ISO 3706.

NOTE 1 The ratio $H_3PO_4 / \frac{1}{2} (P_2O_5) = 1{,}381$ by mass.

NOTE 2 For routine purposes the phosphoric acid concentration can be determined from measurement of the density, as described in annex C.

5.2.3 Chemical parameters and indicator parameters

5.2.3.1 Determination of iron (Fe)

The contents of iron shall be determined in accordance with ISO 6353-2, R 22 (AAS).

5.2.3.2 Determination of metals

5.2.3.2.1 General

The content of metals shall be determined using the procedures specified in Table 2.

Table 2 — Procedures for the determination of metals

Element	Reference	Method	Wavelength nm	Flame
As	see 5.2.3.2.3	Hydride AAS	193,7	n.a.
Sb	see 5.2.3.2.3	Hydride AAS	217,6	n.a.
Cd	see 5.2.3.2.2	AAS	228,8	air-acetylene
Cr	see 5.2.3.2.2	AAS	357,8	air-acetylene
Pb	see 5.2.3.2.2	AAS	217,0 or 283,3	air-acetylene
Ni	see 5.2.3.2.2	AAS	232,0	Oxidizing air-acetylene
Se	see 5.2.3.2.3	Hydride AAS	196,0	n.a.
Hg	in accordance with ISO 5993	flameless AAS	253,6	n.a.
AAS = atomic absorption spectrometry. n.a. = not applicable.				

5.2.3.2.2 Determination of cadmium (Cd), chromium (Cr), lead (Pb) and nickel (Ni)

5.2.3.2.2.1 Principle

The elements cadmium (Cd), chromium (Cr), lead (Pb) and nickel (Ni) are determined using atomic absorption spectrometry with the standard additions technique.

5.2.3.2.2.2 Reagents

5.2.3.2.2.2.1 Standard solution (100 g/l Cd, Cr or Ni)

The standard solution shall be freshly prepared on the day of use by individual dilution of a stock solution. This stock solution with an Cd, Cr or Ni content of at least 1 mg/l shall be made by dilution of standard solutions of Cd, Cr and Ni which are available from all major suppliers of laboratory chemicals. This stock solution shall be kept in containers of tetrafluoroethylene-hexafluoropropylene copolymer (FEP), polytetrafluoroethylene (PTFE) or polyethylene (PE).

NOTE The stock solution should not be kept for longer than four weeks.

5.2.3.2.2.3 Apparatus

Ordinary laboratory apparatus and the following:

5.2.3.2.2.3.1 Atomic absorption spectrometer with the measurement parameters specified in Table 2.

5.2.3.2.2.4 Procedure

5.2.3.2.2.4.1 Test portion

Weigh 1 g to the nearest 0,01 mg of the laboratory sample into a 100 ml one-mark volumetric flask and make up to the mark at 20 °C with water.

5.2.3.2.2.4.2 Determination

The reference solutions shall be made by spiking the sample with the standard solutions, which contain stepwise increasing contents of the elements to be determined.

NOTE The amount of internal standard to be added can be estimated from a preliminary investigation, determining roughly the metal content of the test sample from simple calibration.

The steps in which internal standards are added shall be at least as high as the estimated content of the test sample. With the spectrometer (5.2.3.2.2.3.1) carry out the measurement with the parameters specified in Table 2 in accordance with the manufacturer's instructions.

Repeat the procedure with all reagents and the same volume of standard solution to be added using water in place of the sample as a blank determination.

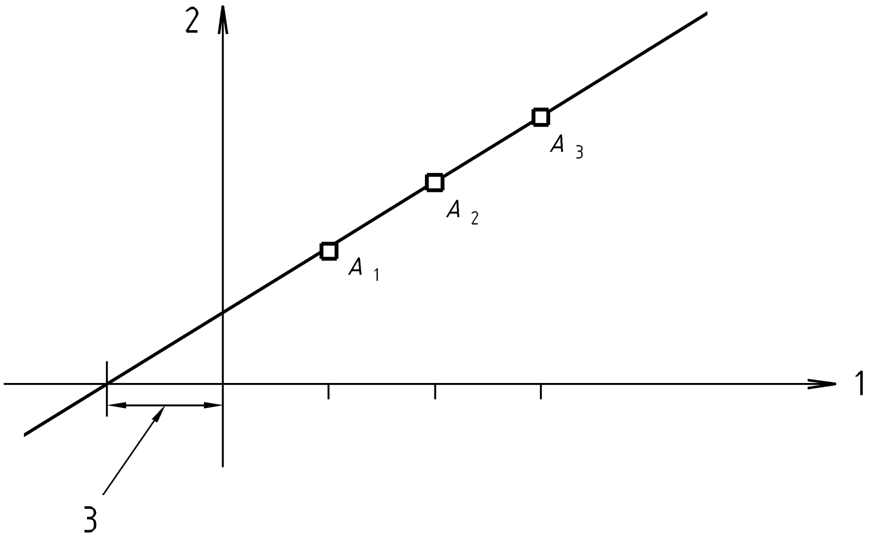
5.2.3.2.2.5 Expression of results

Prepare a calibration curve using the measured absorbances of the spiked measurement solutions.

Read the concentration of each metal in the test solution by extrapolation of the correlation line to absorbance $A = 0$ (see Figure 1). Similarly determine the metal concentration of the blank solution (see Figure 2) and subtract from the result obtained for the test solution.

Alternatively, the evaluation can be carried out by linear regression. Additional dilution steps shall be compensated in the calculation.

The interim result (y) expressed in micrograms per litre is corrected to give the final concentration according to 5.2.3.2.2.6.



Key

1 Mass concentration of added standard in micrograms per litre

2 Absorbance A

3 Mass concentration in the test solution in micrograms per litre

A.1; A.2; A.3 Spiking

Figure 1 — Calculation of the metal concentration in the test solution

5.2.3.2.2.6 Calculation

From the interim results (y) (see 5.2.3.2.2.5), the content, C_3, of each element in the laboratory sample, expressed in milligrams per kilogram of a mass fraction of 100 % phosphoric acid is given by the following equation:

$$C_3 = \frac{y \quad V \quad 100 \quad 1000}{m \quad C_1}$$

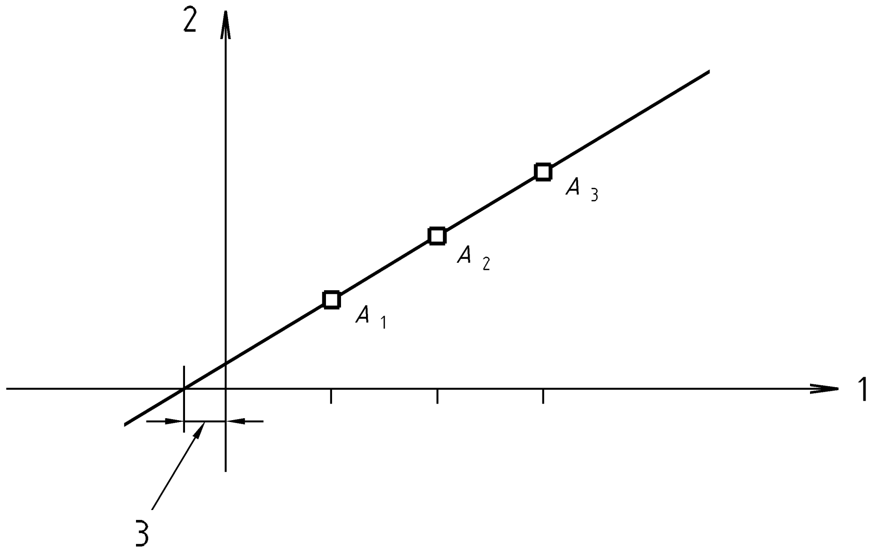
where

y is the interim results (5.2.3.2.2.5);

V is the volume, expressed in millilitres, of the test solution;

m is the mass, expressed in grams, of the test portion;

C_1 is the concentration, expressed in mass fraction in % of phosphoric acid (see 5.2.2).



key

1 Mass concentration of added standard in micrograms per litre

2 Absorbance A

3 Mass concentration in the blank solution in micrograms per litre

A.1; A.2; A.3 Spiking

Figure 2 — Calculation of the metal concentration in the blank solution

5.2.3.2.3 Determination of arsenic (As), antimony (Sb) and selenium (Se)

5.2.3.2.3.1 Principle

The elements arsenic, antimony, and selenium are determined by hydride-atomic absorption spectrometry. The elements are reduced by reducing agents (sodium borohydride ($NaBH_4$)) to form the hydrides. These volatile compounds flow through the heated measuring cuvette of an atomic absorption spectrometer where the content of the individual element is determined.

5.2.3.2.3.2 Reagents

5.2.3.2.3.2.1 Hydrochloric acid, high purity analytical grade, mass fraction of 30 %, density = 1,15 g/ml.

5.2.3.2.3.2.2 Preliminary reduction agent.

Dissolve 10 g sodium iodide and 100 g ascorbic acid in 1 000 ml of water.

5.2.3.2.3.2.3 Reduction agent.

Dissolve with water $NaBH_4$ and NaOH in concentrations specified in the manufacturer's handbook for the spectrometer.

5.2.3.2.3.2.4 Standard solution (100 µg/l As, Sb or Se)

The standard solution shall be freshly prepared on the day of use by individual dilution of a stock solution. This stock solution with an As, Sb or Se content of at least 1 mg/l shall be made by dilution of standard solutions of Se, As and Sb which are available from all major suppliers of laboratory chemicals. This stock solution shall be kept in containers of tetrafluoroethylene-hexafluoropropylene copolymer (FEP), polytetrafluoroethylene (PTFE) or polyethylene (PE).

NOTE The stock solution should not be kept for longer than four weeks.

5.2.3.2.3.3 Apparatus

5.2.3.2.3.3.1 One one-mark volumetric flask, 100 ml.

5.2.3.2.3.3.2 Three one-mark volumetric flasks, 10 ml.

5.2.3.2.3.3.3 Pipettes 2,5 ml, 5 ml, 10 ml, and 20 ml.

5.2.3.2.3.3.4 Three one-mark volumetric flasks, 50 ml.

5.2.3.2.3.3.5 Micropipettes, volume adjustable to maximum 500 l.

5.2.3.2.3.3.6 Atomic absorption spectrometer with the measurement parameters specified in Table 2.

The width of the slit, the measuring time, rinsing with argon before and after the measurement and the reaction time shall be adjusted in accordance with the manufacturer's instructions. The background compensation shall be activated for the measurement of As and Sb, but not for the measurement of Se.

5.2.3.2.3.4 Procedure

For As (procedure for Sb and Se in parentheses if different from As procedure): weigh a test portion of 1 g to the nearest 0,01mg and transfer it to a 100 ml one-mark volumetric flask (5.2.3.2.3.3.1) and make up to the mark at 20 °C with water. Pipette 10 ml (Sb: 10 ml; Se: 20 ml) of this solution into a 50 ml one-mark volumetric flask (5.2.3.2.3.3.4) and add 5 ml HCl (5.2.3.2.3.2.1) and 5 ml preliminary reduction agent (5.2.3.2.3.2.2). Do not add preliminary reduction agent to the flasks for Sb and Se determination. Allow 3 h for reaction to occur and fill to the mark with water. Pipette 2,5 ml (Se: 5 ml) of this solution into three 10 ml one-mark volumetric flasks (5.2.3.2.3.3.2) labelled A,B,C. Add 0,8 ml of HCl (5.2.3.2.3.2.1) to each flask. For the purpose of internal calibration add those quantities of standard solutions (5.2.3.2.3.2.4) as given in Table 3 to the flasks B and C. With the spectrometer (5.2.3.2.3.3.6), carry out the measurement with the addition of the reduction agent (5.2.3.2.3.2.3) and the parameters of measurement in accordance with the manufacturer's instructions for the spectrometer.

Repeat the procedure with all reagents and the same volume of standard solution to be added using water in place of the sample as a blank determination.

Table 3 — Standard solution

	Volume of standard solution to be added		
	As	Sb	Se
Flask B	100 l	100 l	200 l
Flask C	200 l	200 l	500 l

5.2.3.2.3.5 Expression of results

See 5.2.3.2.2.5.

5.2.3.2.3.6 Calculation

See 5.2.3.2.2.6.

5.2.3.3 Determination of sulfuric acid

The content of sulfuric acid shall be determined in accordance with ISO 2997.

NOTE The ratio H_2SO_4 / SO_4 = 1,0219 by mass.

6 Labelling – Transportation – Storage

6.1 Means of delivery

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.

Phosphoric acid shall be delivered in drums of capacity of 30 l to 210 l made of suitable plastics, in tankers made of plastics-lined steel, or of stainless steel.

NOTE There is a risk of phosphoric acid freezing at low temperatures, depending on concentration (see 3.3.6).

6.2 Risk and safety labelling according to the EU Directives [4]

The following labelling requirements apply to phosphoric acid at the date of the publication of this standard.

For concentrations of phosphoric acid above of mass fraction of 25 %:

- symbols and indications of danger:
  - C: corrosive;
- nature of special risks attributed to dangerous substances:
  - R34: causes burns;
- safety advice concerning dangerous substances:
  - S26: in case of contact with eyes, rinse immediately with plenty of water and seek medical advice;
  - S45: in case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

NOTE Annex I of the Directive 67/548/EEC on Classification, packaging and labelling of dangerous substances and its amendments and adaptation in the European Union contains a list of substances classified by the EU. Substances not in this Annex 1 should be classified on the basis of their intrinsic properties according to the criteria in the Directive by the person responsible for the marketing of the substance.

6.3 Transportation regulations and labelling

Phosphoric acid is listed as UN Number[5] 1805.

RID[6] /ADR [7]: class 8, 11 c.

IMDG[8]: class 8.

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[4] See [2].

[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.

IATA[9]: class 8, packing group III.

6.4 Marking

The marking shall include the following:

¾ the name "phosphoric acid", trade name and concentration;

¾ the net mass;

¾ the name and the address of supplier and/or manufacturer;

¾ the statement "this product conforms to EN 974".

6.5 Storage

6.5.1 General

The acid storage tanks shall be made of stainless steel, rubber-lined steel, enamelled steel or various plastics e.g. polypropylene (PP), polyethylene (PE).

Polypropylene (PP) is resistant to a mass fraction of 85 % phosphoric acid up to 100 °C, even if welded. Polyethylene (PE) can be used at temperatures less than 60 °C.

6.5.2 Long term stability

Product is stable; keep container tightly closed to prevent ingress of moisture.

6.5.3 Storage incompatibilities

The product shall be kept away from alkalis, metals, sulfides, sulfites, chlorates, hypochlorites.

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[9] International Air Transport Association.

Annex A
(informative)

General information on phosphoric acid

A.1 Origin

A.1.1 Raw materials

Phosphoric acid is manufactured from phosphate ores.

A.1.2 Manufacturing process

Phosphoric acid is produced either by reduction of phosphate ores to elementary phosphorus by a thermal process and burning the phosphorus to phosphorus pentoxide, which is absorbed by diluted phosphoric acid or by reaction of phosphate ores with sulfuric acid and subsequent solvent extraction.

A.2 Use

A.2.1 Function

Phosphoric acid used in the treatment of water for use as drinking water is used for biological purposes such as nitrification and denitrification. It is also used for corrosion control including plumbosolvency.

A.2.2 Form in which it is used

Phosphoric acid is used as received or as a diluted solution.

Diluted solutions are preferred because of lower viscosity.

A.2.3 Treatment dose

The treatment dose, expressed as H_3PO_4, varies from 0,1 mg/l to 5 mg/l.

A.2.4 Means of application

The treatment dose is usually applied using a metering pump.

A.2.5 Secondary effects

A decrease in the pH value and an increase in nutrient content of the water can occur if phosphoric acid is added in excess.

A.2.6 Removal of excess product

Excess phosphoric acid should be neutralized with alkali which is suitable for water treatment.

Annex B
(normative)

General rules relating to safety

B.1 Rules for safe handling and use

The supplier shall provide current safety instructions.

The place where phosphoric acid is stored or handled shall be made of acid-proof material inside a bunded area, to catch any spillage.

B.2 Emergency procedures

B.2.1 First aid

Take off immediately all contaminated clothing.

In case of contact with skin, wash immediately with plenty of water.

In case of contact with eyes: if even small amounts of phosphoric acid enter the eyes, rinse immediately with water for at least 15 min, with the eye lids held open. Consult immediately a doctor.

B.2.2 Spillage

Large spillage: phosphoric acid shall be collected and pumped off and be carried away in closed containers. Unless they are made of stainless steel, do not use metal containers.

Small spillage: dilute with plenty of water, neutralize with lime or sodium carbonate. Rinse off small quantities with plenty of water.

B.2.3 Fire

Extinguishing media: no restriction in fire situations.

Annex C
(informative)

Determination of concentration by measurement of density

The concentration of a solution of phosphoric acid can be determined from a measurement of its density, for example by the method described in ISO 649-2 [3] or that in ISO 758 [4], using the data given in Table C.1 calculated by J.Christensen and R.Reed [5] and E.Egan and B.Luff [6].

Table C.1 — Concentration and density of phosphoric acid (density measured at 20 °C)

Upper figure: mass fraction in % of H_3PO_4.

Lower figure: mass fraction in % of P_2O_5.

Density (g/ml)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1,51	68,61	68,71	68,80	68,90	69,00	69,10	69,20	69,30	69,39	69,49
	49,71	49,78	49,85	49,92	49,99	50,06	50,13	50,21	50,28	50,35
1,52	69,59	69,69	69,78	69,88	69,98	70,08	70,18	70,27	70,37	70,47
	50,42	50,49	50,56	50,65	50,70	50,77	50,84	50,92	50,99	51,06
1,53	70,56	70,66	70,76	70,85	70,95	71,05	71,14	71,24	71,34	71,43
	51,13	51,20	51,26	51,33	51,40	51,47	51,54	51,61	51,66	51,75
1,54	71,53	71,62	71,72	71,82	71,91	72,01	72,10	72,20	72,30	72,39
	51,82	51,89	51,96	52,03	52,10	52,17	52,24	52,31	52,38	52,45
1,55	72,49	72,58	72,68	72,77	72,87	72,96	73,06	73,15	73,25	73,34
	52,52	52,59	52,65	52,72	52,79	52,85	52,91	52,95	53,06	53,13
1,56	73,44	73,53	73,62	73,72	73,81	73,91	74,00	74,10	74,19	74,25
	53,20	53,27	53,34	53,41	53,48	53,55	53,62	53,69	53,76	53,82
1,57	74,38	74,47	74,56	74,66	74,75	74,84	74,94	75,03	75,12	75,22
	53,89	53,96	54,02	54,09	54,16	54,23	54,30	54,36	54,43	54,50
1,58	75,31	75,40	75,50	75,59	75,68	75,78	75,87	75,95	76,05	76,14
	54,57	54,63	54,70	54,76	54,83	54,90	54,96	55,03	55,09	55,16
1,59	76,24	76,33	76,42	76,51	76,61	76,70	76,79	76,85	76,97	77,05
	55,23	55,30	55,35	55,43	55,50	55,56	55,63	55,70	55,76	55,83
1,60	77,15	77,25	77,34	77,43	77,52	77,61	77,70	77,80	77,89	77,98
	55,90	55,96	56,03	56,09	56,16	56,23	56,30	56,36	56,43	56,50

"to be continued"

Table C.1 (*concluded*)

Upper figure: mass fraction in % of H_3PO_4.

Lower figure: mass fraction in % of P_2O_5.

Density (g/ml)	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1,61	78,07	78,16	78,25	78,34	78,43	78,52	78,61	78,70	78,79	78,88
	56,56	56,63	56,69	56,76	56,82	56,89	56,95	57,02	57,09	57,15
1,62	78,97	79,06	79,15	79,24	79,33	79,42	79,51	79,60	79,69	79,76
	57,21	57,28	57,34	57,41	57,47	57,54	57,60	57,67	57,73	57,80
1,63	79,87	79,96	80,05	80,14	80,23	80,32	80,41	80,50	80,58	80,67
	57,86	57,93	58,00	58,05	58,13	58,19	58,25	58,32	58,39	58,45
1,64	80,76	80,85	80,94	81,03	81,12	81,20	81,29	81,35	81,47	81,56
	58,51	58,58	58,64	58,71	58,77	58,83	58,90	58,95	59,03	59,09
1,65	81,65	81,74	81,82	81,91	82,00	82,09	82,17	82,25	82,35	82,44
	59,15	59,21	59,28	59,35	59,41	59,47	59,53	59,60	59,66	59,72
1,66	82,52	82,61	82,70	82,79	82,88	82,96	83,05	83,14	83,22	83,31
	59,78	59,85	59,91	59,98	60,04	60,10	60,16	60,23	60,29	60,35
1,67	83,40	83,49	83,57	83,66	83,75	83,84	83,92	84,01	84,10	84,18
	60,41	60,48	60,54	60,61	60,67	60,73	60,79	60,85	60,92	60,98
1,68	84,27	84,36	84,44	84,53	84,61	84,70	84,79	84,87	84,96	85,05
	61,04	61,10	61,17	61,23	61,29	61,36	61,42	61,49	61,55	61,62
1,69	85,13	85,22	85,30	85,39	85,47	85,56	85,64	85,73	85,82	85,90
	61,68	61,74	61,80	61,86	61,92	61,98	62,04	62,11	62,17	62,23
1,70	85,99	86,07	86,16	86,24	86,33	86,41	86,50	86,59	86,67	86,75
	62,29	62,36	62,42	62,49	62,55	62,61	62,67	62,73	62,79	62,85
1,71	86,84	86,92	87,01	87,09	87,16	87,26	87,34	87,41	87,51	87,60
	62,92	62,98	63,04	63,1	63,15	63,22	63,28	63,33	63,4	63,47
1,72	87,68	87,76	87,85	87,93	88,02	88,10	88,18	88,27	88,35	88,43
	63,53	63,58	63,65	63,71	63,77	63,83	63,89	63,95	64,01	64,07
1,73	88,52	88,60	88,68	88,77	88,85	88,93	89,02	89,10	89,16	89,26
	64,14	64,19	64,25	64,32	64,37	64,43	64,5	64,56	64,6	64,67
1,74	89,36	89,43	89,51	89,60	89,68	89,76	89,84	89,92	90,01	90,09
	64,74	64,79	64,85	64,92	64,98	65,03	65,09	65,15	65,22	65,27

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