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Specification for

# Chemical preparations for portable and transportable chemical closets (excluding those for use in aircrafts)

UDC 615.28:628.42

# Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Disinfectants Standards Committee (DIC/-) to Technical Committee DIC/1, upon which the following bodies were represented:

Association of District Councils
British Association for Chemical Specialities
Caravan Club
Chemical Industries Association
Consumer Policy Committee of BSI
Department of Trade and Industry (Laboratory of the Government Chemist)
Institution of Environmental Health Officers
Society of Chemical Industry
Water Authorities Association

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# Contents

# Foreword

This revision of this British Standard has been prepared under the direction of the Disinfectants Standards Committee. It supersedes BS 2893:1957, which is withdrawn.

The chemical preparations usually contain biocidal ingredients, colouring and wetting agents and may contain re-odourizing agents for masking odours and are intended to be used in one or more of the following types of closet:

a) non-flushing closets;

b) flushing closets of the non-recirculating type;

c) flushing closets of the recirculating type;

including those complying with BS 2081, except for closets used on board aircraft.

The main changes introduced in this revision are:

1) the biological efficacy of the preparations is specified in terms of performance rather than compositional requirements;

2) the attributes that cannot be specified objectively have been transferred to Appendix A.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

**Summary of pages**

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

## 1 Scope

This British Standard specifies performance requirements for chemical preparations for use in portable and transportable chemical closets, except for closets used in aircraft.

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

## 2 Definitions

For the purposes of this standard, the definitions listed in BS 5283 apply, together with the following.

**2.1**
**product**

the chemical preparation as marketed by the manufacturer or supplier

NOTE Chemical preparations are hereafter referred to as "the product"

**2.2**
**prime dilution**

the highest recommended concentration when first charging the chemical closet with product and water

NOTE This is often referred to as prime charge.

**2.3**
**maximum dilution**

the minimum concentration of the product recommended by the supplier

NOTE The maximum dilution is normally expressed in relation to maximum working capacity of a closet

## 3 Antimicrobial value

The product at 60 % of its maximum dilution shall have an antimicrobial value at least equivalent to a 0.6 g/L solution of formaldehyde, i.e. shall pass the test described in Appendix B.

## 4 Colour stability

The colour of the preparation at maximum dilution shall not discolour or break down after being kept for 72 ± 1 h at pH 3 ± 0.5 and at pH 11 ± 0.5, when tested in accordance with the method described in Appendix C.

## 5 Stability before dilution

Two separate samples of the preparation, after standing for three months at 5 ± 2 °C and 30 ± 2 °C respectively, shall still meet all the requirements of this standard.

The samples under examination shall be stored in the original, sealed and unopened retail containers. The samples shall be stored so that they are not exposed to direct sunlight or to localized overheating.

## 6 Stability after dilution

Solutions of the product at prime dilution and at maximum dilution in both deionized water and standard hard water shall not break up or separate when left standing for 72 ± 1 h at 5 ± 2 °C and at 30 ± 2 °C when tested in accordance with the method described in Appendix D.

## 7 Flash point

A prime dilution of the product shall have a flashpoint not lower than 65 °C, when tested by the method described in BS 2000-34.

NOTE The test procedure need not be completed if the flashpoint has not been reached at 65 °C.

## 8 Compatibility with closet materials

The product shall not cause any perceivable deterioration of the materials of construction of those types of closet complying with BS 2081 for which the supplier recommends the product when tested in accordance with the method described in Appendix E.

## 9 Marking and labelling

The retail container of the product shall be marked with, or shall have attached to it a label bearing the following:

a) full details of the type(s) of closet for which use of the product is recommended;

b) instructions for safe handling of the product (including an instruction not to mix with other chemicals) and for safe and environmentally acceptable procedures for discharging the mixture of diluted product and soil from the closet;

c) instructions for preparing the prime dilution and information on the maximum dilution recommended by the supplier and its relationship to maximum working capacity of the closet;

d) instructions for safe storage of the product;

e) the number and date of this British Standard, i.e. BS 2893:1988[1)].

[1)] Marking BS 2893:1988 on or in relation to a product represents a manufacturer's or supplier's declaration of conformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification of conformity, which may also be desirable.

## Appendix A Recommendations for properties of the product that cannot be specified objectively

### A.1 Introduction

This appendix describes properties that should be present in the product but that are not specified objectively. Inclusion of corresponding requirements in clause **3** would therefore not result in a specification with which compliance could with confidence be claimed, challenged or determined. Suppliers should normally ensure that their products possess these properties to the necessary degree and should formulate the products accordingly on the basis of experience and users' views.

### A.2 Colour

**A.2.1** The product should contain sufficient colour, preferably blue or green shades, to mask organic waste and indicate a chemically charged toilet.

**A.2.2** In the case of products recommended for use in non-flushing closets without a covered waste container, the product even at maximum dilution should contain sufficient colouring matter to obscure from sight submerged excreta and paper.

**A.2.3** In the case of products recommended for use in flushing closets of the recirculating type, the diluted product should contain sufficient colouring matter, or alternatively decolourizing material, to ensure that the flush is always of an acceptable appearance.

### A.3 Odour

The diluted product should be free from objectionable odour.

### A.4 Deodorant or reodorant action

The diluted product should remove or mask malodours rapidly and effectively from human excreta and leave an acceptable level of odour in the closet.

### A.5 Gas prevention

The diluted product should prevent the release of obnoxious or explosive gases from human excreta.

### A.6 Effects on skin and mucous membranes

In the case of products recommended for use in non-flushing toilets without covered waste containers, the diluted product should be non-injurious to the skin and mucous membranes.

### A.7 Cleansing

The composition of the diluted product should facilitate rinsing out of the waste container after emptying.

### A.8 Period of effectiveness

In use, the diluted product, if not further dilute and if all the solid material is fully submerged, should retain effectively the properties described in **A.2** to **A.7** inclusive for at least 3 days at temperatures of 5 ± 2 °C and 30 ± 20 °C.

## Appendix B Method of test for antimicrobial value

### B.1 Principle

A challenge culture is mixed with a fixed amount of yeast suspension. This mixture constitutes a challenge medium which is then added in a specified amount to a specific dilution of the product under test; further additions are made after 24 h and 48 h. After contact times of 24 h, 48 h and 72 h, aliquot portions are taken and placed in tubes containing inactivator. After 5 min, aliquot portions are taken from these tubes and placed in five replicate tubes of recovery broth and are incubated at 37 °C for 48 h and then examined for growth.

The procedure is repeated using a fixed amount of formaldehyde solution in place of the solution under test, as a check.

NOTE 1 The overall result is determined using information obtained for product contact times of 24 h and 48 h only. This method makes reference to a product contact time of 72 h and the procedure relating to this contact time may be omitted. However, operators often find it useful to apply the method, as described, especially as contact times of 24 h, 48 h and 72 h apply for the formaldehyde test dilution.

NOTE 2 This method is based on that described in BS 6905 but differs with regard to contact times and comparison of product performance with that of a solution of 0.6 g/L formaldehyde. Operators may find it useful to read BS 6905.

### B.2 Sterilization

Reagents, media, materials and apparatus shall be sterilized by being kept at either:

a) 170 °C to 175 °C for not less than 1 h in an oven (dry sterilization[2)]); or

b) 121 ± 1 °C for not less than 15 min in an autoclave (wet sterilization).

Manipulation of sterile material and of bacterial cultures shall be carried out aseptically.

### B.3 Reagents and materials

**B.3.1** *General.* All reagents shall be of recognized biological or analytical grade and distilled water or water otherwise produced shall comply with BS 3978. All solutions and media shall be freshly prepared.

[2)] This method is suitable for dry glassware only.

**B.3.2** *Hard water.* Dissolve 0.305 g of anhydrous calcium chloride and 0.139 g of magnesium chloride hexahydrate in water and dilute to 1 000 mL with water. Sterilize in accordance with **B.2**.

NOTE The water has a value of 342 mg/L hardness.

**B.3.3** *Recovery medium.* Using a pipette or an automatic dispenser (**4.2.2**), dispense standard strength Oxoid Nutrient No. 2 broth[3)], containing 30 g/L of Tween 80[3)], into test tubes in 10 mL aliquot portions and sterilize in accordance with **B.2**. Each test requires 30 such tubes.

**B.3.4** *Solid culture medium.* Prepare Oxoid Nutrient Agar[3)] in accordance with the manufacturer's instructions and sterilize in accordance with **B.2**.

**B.3.5** *Test organism. Escherichia coli* NCTC 8196.

NOTE This organism has been categorized by the Advisory Committee on Dangerous Pathogens as a hazard group 2 pathogen and work with viable material should be conducted according to their recommendations for containment level 2.

**B.3.6** *Yeast suspension.* Prepare a yeast suspension containing 50 g/L calculated on a dry mass basis as described in **5.5** of BS 808:1986, but using the hard water (**B.3.2**) in place of water complying with BS 3978.

**B.3.7** *Inactivator solution.* Dissolve 20 g of egg lecithin and 30 mL of a 10 % (*m*/*m*) approximately, aqueous solution of Lubrol W[3)] and dilute to 1 000 mL with water. Dispense into test tubes in 9 mL aliquot portions and sterilize in accordance with **B.2**. Each test requires six such tubes.

**B.3.8** *Ringer's solution, quarter strength.* Use freshly prepared solution. Dissolve 9.00 g of sodium chloride, 0.42 g of potassium chloride, 0.24 g of anhydrous calcium chloride and 0.20 g of sodium hydrogen carbonate in water and dilute to 1 000 mL with water. Add one volume of this solution to three volumes of water to give a quarter-strength solution. Dispense 9 mL aliquot portions into sterile universal container culture bottles (**B.4.2.3**) and sterilize in accordance with **B.2**.

NOTE Tablets are commercially available.

**B.3.9** *Liquid growth medium.* Standard strength Oxoid Nutrient No. 2.

**B.3.10** *Formaldehyde solution* of known concentration.

NOTE Analytical grade formaldehyde solution contains 37 % to 41 % (*V*/*V*) formaldehyde and 10 % to 14 % (*V*/*V*) methanol as a stabilizer. It is necessary to know the exact concentration to prepare the test dilution (see **B.7.2**). The concentration may be measured using the method described in BS 2942.

## B.4 Apparatus

**B.4.1** *General.* The apparatus shall be sterile (see **B.2**) and scrupulously clean before use.

**B.4.2** *Ordinary microbiological apparatus*

**B.4.2.1** *Micropipetter,* high precision, adjusted to dispense accurately 200 µL, with sterile tips suitable for use with the micropipetter.

**B.4.2.2** *Graduated pipettes,* capable of delivering 2 mL, 6 mL and 9 mL, and complying with class B of BS 700-1, or an automatic dispenser capable of delivering 2 mL, 6 mL and 9 mL with the same degree of accuracy.

**B.4.2.3** *Universal container culture bottles,* of capacity 28 mL.

NOTE The containers should be made of glass with screwed metal caps with rubber liners.

**B.2.4.4** *Incubator,* capable of being controlled at 37 ± 1 °C.

## B.5 Preparation of test cultures

### B.5.1 *Initial cultures*

Obtain the test organism (**B.3.5**) in a tube in freeze-dried form and reconstitute in accordance with the supplier's instructions.

### B.5.2 *Stock cultures*

Spread a loopful of the initial culture (**B.5.1**) over the surface of a slope of sterilized solid culture medium (**B.3.4**). Incubate for 24 h in the incubator (**B.2.4.4**) controlled at 37 ± 10 °C, and then store at below 22 °C and preferably between 4 °C and 10 °C, until required.

### B.5.3 *Broth cultures*

Inoculate a tube containing 10 mL of the liquid growth medium (**B.3.9**) from the stock culture (**B.5.2**) and incubate for 24 h, in the incubator (**B.2.4.4**) controlled at 37 ± 1 °C. Progressively sub-culture into fresh liquid growth medium every 24 h. After 10 days restart the process using a fresh stock culture.

## B.6 Preparation of challenge medium

**B.6.1** Transfer a 6 mL aliquot portion of a sub-culture, that has been treated in accordance with **B.5.3** for at least 5 days but not more than 10 days, to a sterile universal container culture bottle (**B.4.2.3**) containing 4 mL of the yeast suspension (**B.3.6**) and mix.

[3)] For information on the availability of reagents and materials, apply to Enquiry Section, BSI, Linford Wood, Milton Keynes MK14 6LE enclosing a stamped addressed envelope for reply.

**B.6.2** Immediately before the test, count the number of viable organisms in the challenge medium by means of decimal dilutions in the quarter-strength Ringer's solution (**B.3.8**). Prepare plates in duplicate from 1 mL of each of the dilutions from $10^{-4}$ to $10^{-7}$ and 10 mL of the sterilized solid culture medium (**B.3.4**), previously melted and cooled to about 45 °C. Incubate the set plates for 48 h in the incubator controlled at 37 ± 1 °C. If the number of viable organisms is lower than $10^8$ per mL or greater than $10^{10}$ per mL, prepare a fresh challenge medium.

**B.7 Preparation of test dilutions**

**B.7.1** ***Product under test***

Using the hard water (**B.3.2**), prepare on a mass-for-mass basis a solution of the product equal to 60 % of its maximum dilution, i.e. 60 % of the minimum concentration of the product recommended by the supplier.

**B.7.2** ***Formaldehyde***

Using the hard water (**B.3.2**) prepare a solution containing 0.6 g/L formaldehyde (see **B.3.10**).

**B.7.3** ***Test solutions***

Place a 6 mL aliquot portion of the diluted product under test (**B.7.1**) in a universal container culture bottle (**B.4.2.3**) and label the dilution P. Place a 6 mL aliquot of the diluted formaldehyde (**B.7.2**) in another universal container culture bottle and label the dilution F.

**B.8 Test procedure**

**B.8.1** ***General***

Carry out the test at 20 °C to 22 °C. Add volumes in excess of 1 mL using graduated pipettes or automatic dispenser (**B.4.2.2**) and 200 µL volumes using the micropipetter (**B.4.2.1**) and sterile tips. Label the 30 test tubes containing the recovery medium (**B.3.3**) as follows:

five each labelled P10, P20, P30, F 10, F20 and F30.

**B.8.2** ***Test sequence***

**B.8.2.1** At time 0 h, add 2 mL of challenge medium to product dilution P (see **B.7**), and shake the mixture gently. Then add 2 mL of challenge medium to formaldehyde dilution F (see **B.7.3**) and shake the mixture gently. Allow the dilutions to stand in the dark for 24 h.

**B.8.2.2** At time 0 + 24 h, remove 1 mL aliquot portions from each bottle and transfer each to separate test tubes, labelled P1 and F1, and each containing 9 mL of inactivator solution (**B.3.7**). Shake the mixture gently. After 5 min, take five 200 µL aliquot portions of P1 and transfer one aliquot portion to each of the five tubes P10; similarly transfer five 200 µL aliquot portions of F1 to the five tubes F10. Shake all of the mixtures gently. Incubate the 10 tubes (P10 and F10) for 48 h in the incubator (**B.2.4.4**) controlled at 37 ± 10 °C. Then examine the tubes for growth.

**B.8.2.3** Whilst the aliquot portions and the inactivator solution are standing for 5 min (see **B.8.2.2**) add 2 mL of fresh challenge medium (**B.6**) to product dilutions P and F and shake the mixtures gently. Allow the dilutions to stand in the dark for a further 24 hours.

**B.8.2.4** At 0 + 48 h, repeat the procedures described in **B.8.2.2** but using inactivator solutions in tubes marked P2 and F2 and test tubes containing recovery medium and marked P20 and F20.

**B.8.2.5** Whilst the aliquot portions and the inactivator solutions are standing for 5 min (see **B.8.2.2** and **B.8.2.4**) repeat the procedures described in **B.8.2.3**.

**B.8.2.6** At 0 + 72 h, repeat the procedures described in **B.8.2.2** but use inactivator solutions in tubes marked P3 and F3 and the test tubes containing recovery medium and marked P30 and F30.

NOTE See note 1 to **B.1**.

**B.8.2.7** Record the growth pattern in tabular form as illustrated in Table 1.

**B.9 Interpretation of results**

**B.9.1** Record as a pass a product dilution showing no growth in at least two out of five tubes of recovery medium after contact times of 24 h and 48 h, provided that the formaldehyde dilution meets these same requirements and also shows growth in all five tubes after a contact time of 72 h.

**B.9.2** If the formaldehyde dilution (0.6 g/L) does not exhibit a growth pattern in accordance with **B.9.1**, carry out a new test, first checking that the reagents and materials are in accordance with **B.3**.

**B.10 Test report**

Report the growth patterns for the preparation under test and the formaldehyde dilutions and state whether each dilution passed or failed.

**Table 1 — Examples of growth pattern**

| Test | Organism growth in recovery medium after specified time | | | Result |
|---|---|---|---|---|
| | 24 h | 48 h | 72 h | |
| 1 | +– – – – | +++– – | +++++ | Pass |
| 2 | ++– – – | +++– | +++++ | Fail |
| NOTE Testing of the product at 72 h contact time is optional (see note 1 to **B.1**). | | | | |

## Appendix C Method of test for colour stability

In a 1 L graduated measuring cylinder complying with BS 604, prepare a 1 L solution of the product at maximum dilution using tap water and adjusting the pH to 3 ± 0.5, using formic acid solution.

Store the solution at room temperature for 72 ± 1 h.

Just prior to the end of the storage period, prepare a similar solution in a 1 L graduated measuring cylinder.

After the storage period of 72 ± 1 h is completed, compare the colour and homogeneity of the two solutions and record whether on visual examination there is any variation in colour or colour intensity between the two samples or any sign of breakdown of the solution.

Carry out in parallel the same procedures on further solutions but adjusting the pH to 11 ± 0.5 using sodium hydroxide solution.

## Appendix D Method of test for stability after dilution

### D.1 Reagents

**D.1.1** *Water,* complying with grade 3 of BS 3978.

**D.1.2** *Standard hard water.* Use reagents of a recognized analytical reagent grade.

Prepare standard hard water of 342 mg/L (hardness calculated as $CaCO_3$) by dissolving 0.304 g of anhydrous $CaCl_2$, and 0.139 g of $MgCl_2.6H_2O$ in water complying with BS 3978 and make up to 1 L.

### D.2 Procedure

**D.2.1** Bring the samples and the test waters (**D.1.1** and **D.1.2**) to the test temperatures (5 °C and 30 °C).

**D.2.2** In eight 100 mL stoppered measuring cylinders complying with BS 604 prepare and mix test solutions in accordance with Table 2.

Without further mixing, stand the test solutions for 72 ± 1 h at the test temperatures.

Examine the contents of each cylinder to see whether the solutions have broken up or separated into layers.

## Appendix E Method for determination of compatibility with closet materials

Charge the container with an appropriate quantity of undiluted product of the type recommended by the supplier and allow it to remain for 24 h. If the chemicals are in powder form, use a saturated solution.

Dilute the chemical charge so that its concentration is as specified by the supplier for normal use. Leave this charge in the container for a further period of four weeks. Empty the container and rinse it with clean water. Examine it for deterioration of the material or the surface finish.

**Table 2 — Test solutions**

| **Test solution** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **Dilution** | Prime | Prime | Prime | Prime | Max. | Max. | Max. | Max. |
| **Test water** | BS 3978 | BS 3978 | Hard | Hard | BS 3978 | BS 3978 | Hard | Hard |

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# Publications referred to

BS 604, *Specification for graduated glass measuring cylinders.*

BS 700, *Graduated pipettes.*

BS 700-1, *Specification for general requirements.*

BS 808, *Method for assessing the efficacy of disinfectants by the modified Chick-Martin test.*

BS 2000, *Method of test for petroleum and its products.*

BS 2000-34, *Flash point by Pensky-Martens closed tester.*

BS 2081, *Closets for use with chemicals.*

BS 2942, *Specification for formaldehyde solution.*

BS 3978, *Specification for water for laboratory use.*

BS 5283, *Glossary of terms relating to disinfectants.*

BS 6905, *Method for estimation of concentration of disinfectants used in "dirty" conditions in hospitals by the modified Kelsey-Sykes test.*

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