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## **DRAFT EAST AFRICAN STANDARD**

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**Solvent-based paint remover — Specification**

## **EAST AFRICAN COMMUNITY**

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## Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in the East African Community. It is envisaged that through harmonized standardization, trade barriers that are encountered when goods and services are exchanged within the Community will be removed.

The Community has established an East African Standards Committee (EASC) mandated to develop and issue East African Standards (EAS). The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the public and private sector organizations in the community.

East African Standards are developed through Technical Committees that are representative of key stakeholders including government, academia, consumer groups, private sector and other interested parties. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the Principles and procedures for development of East African Standards.

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

The committee responsible for this document is Technical Committee EASC/TC 070, *Paints, varnishes and related products*.

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

During the preparation of this Standard, reference was made to the following document:

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Acknowledgement is hereby made for the assistance derived from this source.



## Solvent-based paint remover — Specification

### 1 Scope

**1.1** This Draft East African Standard specifies requirements for solvent-based paint removers. The paint removers are intended for general use on painted, varnished or lacquered on metal and other appropriate surfaces

**1.2** Paint removers complying with this standard are considered not for use on items where attack on metals, caused by reaction between the metal and the paint remover, is regarded as critical. A number of plastic and wooden surfaces may also be seriously affected by constituents of these paint removers.

### 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 605, *Paints and varnishes. Standard panels for testing*

ISO 4618, *Paints and varnishes — Terms and definitions*

ISO 15528, *Paints, varnishes and raw materials for paints and varnishes — Sampling*

EN 1423, *Road marking materials. Drop on materials. Glass beads, antiskid aggregates and mixtures of the two*

### 3 Terms and definitions

For the purposes of this document, the definitions given in ISO 4618 together with the following glossary of terms related to paint apply.

**paint remover**

material that when applied to a coated substrate softens the coating so that it can be removed easily

### 4 Requirements

#### 4.1 Specific requirements

The Solvent-based paint remover shall meet the requirements specified in Table 1.

Table 1 — Requirements for Solvent-based paint remover

Sl. No	characteristic	Requirement	Test method
a)	Rate of evaporation, % (m/m),max.	2	Annex A
b)	Paint-removing power	Shall comply	Annex C
c)	Water rinsability,%,max	0.5	Annex D and Annex K
d)	Acidity or alkalinity	Shall comply	Annex E
e)	Corrosive effects	Shall comply	Annex G
f)	Flammability	Shall comply	Annex H
g)	Phenol content	Shall not contain more than 0.2 % (m/m) of phenols expressed as C <sub>6</sub> H <sub>5</sub> OH.	Annex J <sup>a</sup>
<sup>a</sup> Its applicable to Dichloromethane based paint remover			

## 4.2 Storage properties

When stored at a temperature above 0 °C and not exceeding 32 °C in sealed original containers, the product shall meet the requirements as specified in table 1 for a period of not less than 12 months from the date of manufacture.

## 5 Packaging and Labelling

### 5.1 Packaging

**5.1.1** The Paint removers shall be packaged in suitable containers which do not contaminate the content and protects the content from contamination and deterioration of quality.

**5.1.2** The solvent-based paint remover shall be packed in container that is inert to the paint and has a lid that can open and close.

**5.1.3** Containers shall be of sufficient strength to withstand any pressure likely to develop internally during storage under normal conditions. Ullage should be provided to avoid undue pressure developing inside the container when it is stored under normal conditions.

**5.1.4** The containers shall be packed in suitable bulk package material

### 5.2 Labelling

The labelling shall be either in English, Kiswahili or French or in combination as agreed between the manufacturer and / or the supplier. Any other language is optional.

#### 5.2.1 Containers

Containers in which the product is packed shall be legibly and indelibly marked with the following:

- a) The name of the product as "solvent based paint remover";

- b) the manufacturer's name and address;
- c) trade mark if any;
- d) general precautions, i.e. warning and first-aid advice;
- e) Instructions for correct use, storage and disposal;
- f) the batch number;
- g) net content in litres
- h) the date of manufacture
- i) Best before date
- j) any additional labelling required by national legislation for this type of product; and
- k) country of origin/ manufacture.

#### **5.2.2 Bulk packages**

The following information shall appear in legible and indelible marking on the outside of each package:

- a) manufacturer's name;
- b) trade mark if any;
- c) name of the solvent-based paint remover;
- d) the number of containers;
- e) net volume of the contents of each container;
- f) batch number;
- g) month and year of manufacture; and
- h) expiry date;

## **6 Sampling**

Sampling shall be done in accordance to ISO 15528



## Annex A (normative)

### Determination of rate of evaporation

#### A.1 Apparatus

##### A.1.1 Ordinary laboratory apparatus

**A.1.2 Glass dish**, approximately 75 mm internal diameter and 10 mm wall height. The lid of a Petri dish may be used.

**A.1.3 Hypodermic glass syringe**, 10-ml capacity, but without a needle.

**A.1.4 Balance**, Capable of weighing to accuracy of 1 mg or less.

#### A.2 Procedure

**A.2.1** Carry out the procedure in a room controlled at a temperature of  $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ . Place the sealed container containing the product under test in the room at least 16 h before testing<sup>3</sup>.

**A.2.2** Weigh the glass dish (**A.1.2**) to the nearest 1 mg.

**A.2.3** With the top pointing away, carefully open the container to release any excess pressure. Immediately close the container and then gently invert it to ensure the homogeneity of the product under test. Cautiously re-open the container and quickly transfer a sample of approximately 50 ml into a 100-ml squat beaker. Fill the syringe (**A.1.3**) with more than 10 ml of the sample in the beaker at a rate of about 1 ml/s, maintaining the syringe opening approximately 5 mm below the surface of the sample. Invert the syringe and expel the excess liquid until the volume of the product in the syringe is 10 ml. Take care to expel any bubbles. Wipe off any excess of sample from the outside of the syringe and weigh the filled syringe to the nearest 1 mg.

**A.2.4** Expel the contents of the syringe at a rate of about 1 ml/s into the centre of the glass dish (**A.1.2**) placed on a horizontal surface exposed to the air but protected from draughts. Reweigh the syringe. After 30 min  $\pm$  1 min, reweigh the dish and its contents to the nearest 1 mg.

#### A.3 Calculation

The loss in mass  $m_L$  (in %) is given by the equation:

$$m_L = \frac{(m_2 - m_3) - (m_4 - m_1) \times 100}{m_2 - m_3}$$

Where

$m_L$  is the mass of the glass dish (in g);

$m_1$  is the

$m_2$  is the mass of the syringe and the product under test (in g);

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<sup>3</sup> This test should be carried out on a sample removed from a previously unopened container.

$m_3$  is the mass of the syringe after expulsion of the product under test (in g)

$m_4$  is the mass of the dish and the product after standing for 30 min (in g).

## **Annex B (normative)**

### **Assessment of consistency**

#### **B.1 Principle**

The viscosity of the product under test is compared with the viscosity of two reference oils.

#### **B.2 Apparatus**

**B.2.1 Test tubes**, Approximately 11 mm internal diameter.

**B.2.2 Mineral oil**, Viscosity 0.3 Pa.s at  $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ .

**B.2.3 Mineral oil**, Viscosity 0.5 Pa.s at  $25\text{ }^{\circ}\text{C} \pm 1\text{ }^{\circ}\text{C}$ .

#### **B.3 Procedure**

Fill the two test tubes respectively with the mineral oils (B.2.3 and B.2.4) and a third test tube with the product under test. Insert corks into each tube, checking that an air space of  $13\text{ mm} \pm 1\text{ mm}$  is present. Ensure that the temperatures of the tubes and the contents are identical at a temperature of  $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ . Mount the tubes in a suitable apparatus so that they may be inverted simultaneously. Invert the tubes four times, allowing the bubble to rise to the top of the liquid after each inversion. Compare the rates at which the bubbles rise through the liquids in the three tubes during the last inversion.

#### **B.4 Expression of results**

Record the rate of rise of the bubble in the product under test as either:

- a) greater than the rate of rise of the bubble in the low-viscosity oil; or
- b) not greater than the rate of rise of the bubble in the low viscosity oil but not less than the rate of rise of the bubble in the high-viscosity oil, indicating that the product has a viscosity between 0.3 Pa .s and 0.5 Pa.s;  
or
- c) less than the rate of rise of the bubble in the high-viscosity oil.

## Annex C (normative)

### Assessment of relative paint removing power

#### C.1 Principle

The ability of the product under test to remove a reference paint system and its subsequent rinsability are compared with the same characteristics of a reference paint remover.

#### C.2 Apparatus

**C.2.1 Panels**, approximately 100 mm x 150 mm x 0.71 mm, of hard aluminium, acid chromated

**C.2.2 Water spray head**, comprising of a flat perforated plate, approximately 125 mm in diameter, drilled with 75 to 80 holes of 1 mm diameter, distributed uniformly. The holes should be countersunk to within 1 mm of the bottom face. A polymethyl methacrylate sheet, approximately 4 mm thick has been found suitable.

**C.2.3 Constant head device**, for maintaining a head of water of approximately 1.4 m at the spray head

**C.2.4 Panel stand**, for supporting a panel at 45°.

**C.2.5 Stop-clock**, Accuracy to 0.1 s.

**C.2.6 Glass syringe**, 2-ml capacity, with a needle.

#### C.3 Materials

##### C.3.1 Reference finishing paint

A two-component, cold-curing vehicle consisting of an epoxide resin and a polyamide-curing agent, either or both pigmented, suitable for direct application to the panels

##### C.3.2 Reference primer

A two-component, cold-curing polyurethane finish consisting of a polyester vehicle and an aliphatic isocyanate curing agent, either or both pigmented, compatible with the reference primer. Panels suitably coated with a reference paint system may be obtained from paint manufacturers.

##### C.3.3 Reference paint remover

This is a reference material for use only in the test for assessment of relative paint-removing power. The reference paint remover shall consist of the following:

- a) g of paraffin wax with a softening point of 50 °C to 55 °C.
- b) g of trichloroethylene;
- c) 78.5 g of dichloromethane
- d) 1.5 g of high-substitution methyl cellulose solid), having a viscosity of 0.1 Pa.s  $\pm$  0.015 Pa.s when in a 2 % (m/m) aqueous solution;
- e) 12.0 g of industrial methylated spirits,

Prepare the reference paint remover by melting the paraffin wax and adding it to the trichloroethylene. Stir until mixed and then add the mixture to the dichloromethane. Whilst stirring, add the remaining constituents in

the order d, e, f and store the final product in a suitable sealed container. Discard the reference paint remover 1 month after its preparation.

#### **C.4 Preparation of test surface**

Prepare two test panels for each product under test by applying uniformly, preferably by spray, a coating of the reference primer to give a dry-film thickness of  $15\ \mu\text{m} \pm 3\ \mu\text{m}$ . Allow the primer to dry at a temperature of  $23\ ^\circ\text{C} \pm 2\ ^\circ\text{C}$  and relative humidity of  $(50 \pm 5)\%$  for 24 h.

Apply the reference finishing paint (C.3.1) to both test panels using a brush or spray, to give a uniform dry-film thickness of  $30\ \mu\text{m} \pm 2.5\ \mu\text{m}$ . Allow the test panels to condition at a temperature of  $23\ ^\circ\text{C} \pm 2\ ^\circ\text{C}$  and relative humidity of  $(50 \pm 5)\%$  with free access of air, for at least 14 days.

#### **C.5 Procedure**

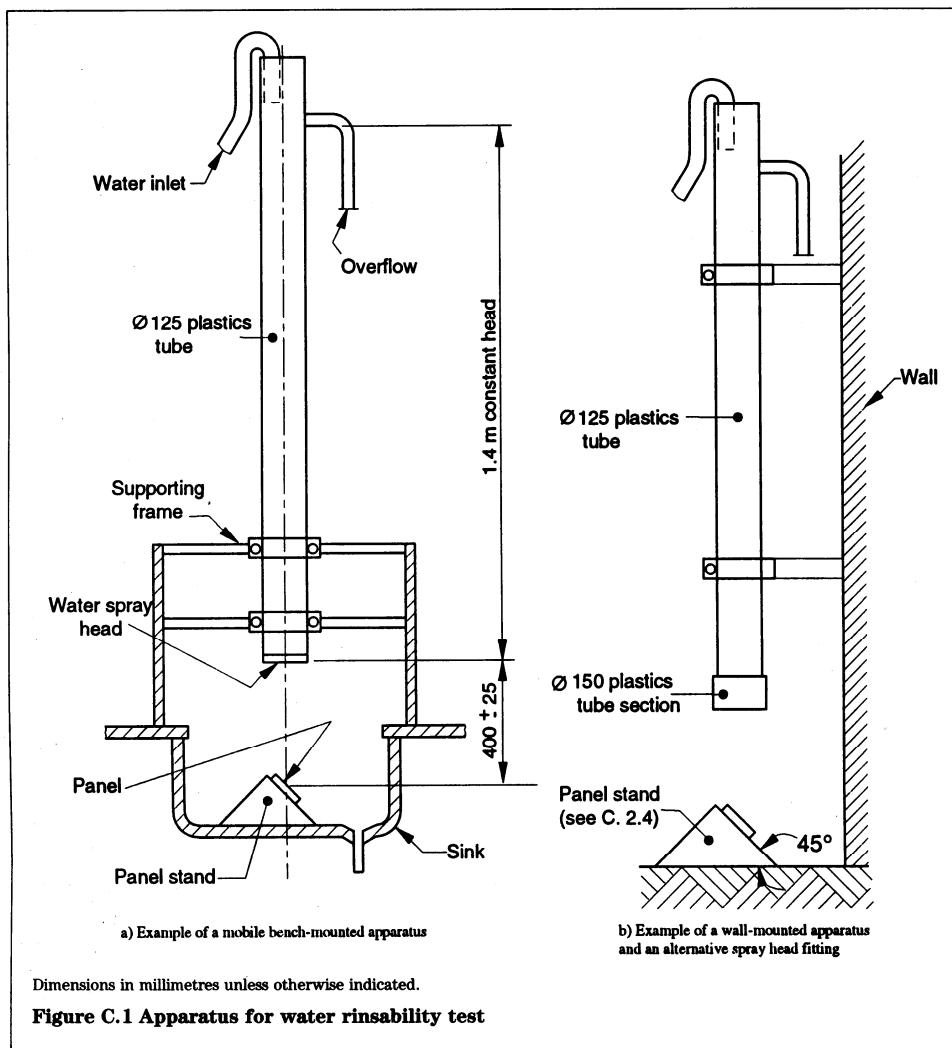
**C.5.1** For each product under test, mark out and identify 30 squares, approximately 25 mm x 20 mm, on each of the duplicate test panels prepared as described in C.4. Place the test panels horizontally.

**C.5.2** Apply to one of the test panels, by means of the glass. Syringe (C.2.6), 0.1 ml of the material under test to the centre of each of 15 alternate squares at 10 intervals to form a diagonal lattice pattern. Immediately apply in the same manner 0.1 ml of the reference paint remover (C.3.3) to the centre of each of the remaining (vacant) Squares. Start the stop-clock (C.2.5).

#### **C.6 Report**

The product shall not be inferior to the reference paint remover using the following criteria:

- a) The average time taken for the paint, applied to either of the test panels, to wrinkle or lift shall not exceed that of the reference paint remover;
- b) After subjection to the washing procedure (see clause C.5.5), the squares treated with the product under test shall retain no more of the applied reference paints than the squares treated with the reference paint remover



**Figure C.1 — caption**

**C.5.3** After completing the application, continue to examine the panel, and record the time for the paint to wrinkle or lift in each square. Calculate for each square the period to wrinkle or lift and then calculate the average periods both for the product under test and for the reference paint remover.

If for either the product or the reference paint remover, the time for the paint film to lift or wrinkle in more than two squares exceeds twice the average of the time taken by the remaining areas, repeat the test. If one or two test squares take an excessive time to wrinkle or lift, then calculate an average from the time taken by the remaining squares.

**C.5.4** Repeat the procedure described in C.5.2 and C.5.3 on a duplicate test panel.

**C.5.5** After the last test square of paint on a panel has wrinkled or lifted or 1 h after application of the last drop, whichever is the less, fix the panel in the stand (C.2.4) ensuring that the lower edge of the panel is above the level reached by the drainage water (see figure C.1). Place the water spray head (C.2.2) such that its centre is 400 mm ± 25 mm above the centre of the panel, and connect the constant head device (C.2.3) to the spray head.

Allow the flow of water from the spray head to flush the test panel for 120 s ± 10 s. At the end of this period, remove the panel and shake it to remove any remaining water. Visually examine the surface of the panel at the centre of each test square for residues of the reference paint system.

**C.6 Expression of results, report the following:**

- a) Whether the average time taken for the paint to be wrinkled or lifted by the product under test was longer or shorter than that taken by the reference paint remover; or
- b) whether, after washing, the amount of paint retained on the squares treated by the product under test is greater or less than that on the square treated by the reference paint remove.

## Annex D (normative)

### Determination of water rinsability

#### D.1 Principle

An aluminium test panel, treated with the paint remover, is rinsed with water and any gain in mass is recorded. The panel, after being gently brushed in water and allowed to dry, is coated with a priming paint and the properties of this coating are compared with a coating applied to a reference test panel.

#### D.2 Apparatus and material

**D.2.1 Panels**, of approximately 100 mm x 150 mm x 0.71 mm, of hard aluminium, acid chromated.

**D.2.2 Water**; Spray head (C.2.2).

**D.2.3 Constant head device** (C.2.3).

**D.2.4 Panel stand** (C.2.4).

**D.2.5 Paint brush**, flat, 25 mm

**D.2.6 Balance** (A.1.4).

**D.2.7 White solvent-thinned priming paint**

#### D.3 Procedure

**D.3.1** Weigh a panel (D.2.1) to the nearest 1 mg. Apply  $5 \text{ g} \pm 0.5 \text{ g}$  of the product under test evenly to one face and immediately reweigh the panel. Allow the panel to stand in a horizontal draught-free position at a temperature of  $23^\circ\text{C} \pm 2^\circ\text{C}$  for 30 min.

**D.3.2** At the end of the 30 min period, place the panel centrally under the water spray head (D.2.2) and rinse as described in C.5.5. After  $120 \text{ s} \pm 10 \text{ s}$  remove the panel and allow it to dry at a temperature of  $23^\circ\text{C} \pm 2^\circ\text{C}$  with free access to air for 24 h.

**D.3.3** Weigh the panel to the nearest 1 mg.

**D.3.4** Place the panel in a bath of water and gently brush away any residues for  $120 \text{ s} \pm 10 \text{ s}$ . Take the panel from the bath, shake the panel to remove surplus water and allow to dry at a temperature of  $23^\circ\text{C} \pm 2^\circ\text{C}$  for 24 h. Weigh the panel to the nearest 1 mg. If the mass of the panel has increased by 25 mg or more discard the test.

**D.3.5** Apply coat of the white solvent-thinned priming paint (D.2.7) to the panel. Similarly apply the paint to a second panel to which has been carried out only the procedure described in D.3.2. Apply the paint at a similar mass to both panels.

By comparison of the two panels, record whether the surface-dry properties of the priming paint when tested in accordance with annex K or the appearance of the dry film after 16 h have been impaired by use of the paint remover.



#### D.4 Calculation

The increase in mass  $L'm_i$  (in %) is given by the equation:

$$m_i = \frac{(m_7 - m_5) \times 100}{m_6 - m_5}$$

where

$m_5$  is the mass of the panel (see D.3.1) (in g);

$m_6$  is the mass of the panel after application of the paint remover (see D.3.1) (in g);

$m_7$  is the mass of the panel after rinsing and drying (see D.3.3) (in g).

#### D.5 Expression of results

The report shall include a statement on the percentage increase in mass, the surface-dry properties of the treated and untreated panels and an assessment of the appearance of the treated panel compared with the untreated panel.

## Annex E

(normative)

### Determination of acidity or alkalinity

#### E.1 Reagents

Reagents used should be of recognized analytical reagent quality. Distilled water or deionised water of at least equal purity should be used.

**E.1.1 Methyl orange indicator solution**, 0.4 g/l.

**E.1.2 Phenolphthalein indicator solution**, 10 g/l.

**E.1.3 Hydrochloric acid, standard volumetric solution**,  $c(\text{HCl}) = 0.1 \text{ mol/l}$ .

#### E.2 Procedure

**E.2.1** Vigorously shake  $10 \text{ g} \pm 0.1 \text{ g}$  of the product under test with 30 ml of water for 5 min. Add three drops of the methyl orange indicator solution (E.1.1) and, if a red colour is observed, report the sample as acidic to methyl orange.

**E.2.2** Vigorously shake  $10 \text{ g} \pm 0.1 \text{ g}$  of the product under test with 30 ml of water for 5 min and add three drops of the phenolphthalein indicator solution (E.1.2).

If no pink colour is produced, report the sample as having an alkalinity less than 0.08 % (*m/m*) calculated as sodium hydroxide.

If a pink colour is produced when the phenolphthalein solution is added, titrate with the hydrochloric acid solution (E.1.3) until the coloration has been permanently discharged.

#### E.3 Calculation

Calculate the alkalinity *A* (in % (*m/m*)) of sodium hydroxide in the sample from the following equation:

$$A = \frac{V(40 \times 0.1 \times 100)}{m \times 1000}$$

$$= \frac{0.4V}{m}$$

where

*A* is the alkalinity of sodium hydroxide (in % (*m/m*));

*V* is the volume of hydrochloric acid used to discharge the pink colour of phenolphthalein (in ml);

*M* is the mass of paint remover (in g).

#### E.4 Expression of results

The report shall state one of the following:

- a) the product is acidic to methyl orange;

- b) the product has an alkalinity less than 0.08 % (*m/m*) calculated as sodium hydroxide;
- c) the alkalinity of the product, expressed as a percentage by mass of sodium hydroxide.

## **Annex G**

(normative)

### **Determination for corrosive effects**

#### **G.1 Principle**

The mass loss of a steel strip immersed in the product for a specified time is determined.

#### **G.2 Test piece**

The test piece shall be 20 mm x 125 mm x 1.25 mm, of steel strip

#### **G.3 Procedure**

**G.3.1** Weigh the test piece (see G.2) to the nearest 1 mg.

**G.3.2** Completely immerse the steel test piece in the product under test contained in a test tube, stopper the tube and maintain it at a temperature of  $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  for 7 days.

**G.3.3** At the end of the exposure period, remove the adhering material from the test piece using a suitable solvent, and visually inspect the test piece for rusting or corrosion.

**G.3.4** After drying the test piece, weigh it to the nearest 1 mg.

#### **G.4 Expression of results**

Record the difference between the mass of the test piece, before and after the test. Record any corrosion of the test piece.

#### **G.5 Report**

The product shall not cause visible rusting or corrosion of the steel test piece and the mass of the test piece shall not be increased by more than 1 mg nor decreased by more than 5 mg.

## **Annex H** (normative)

### **Test for flammability**

#### **H.1 Principle**

A quantity of the product under test is applied to degreased test panels and the product is ignited with a specified flame. The flame is applied for a specified time at five time intervals allowing for varying evaporation rates of constituent materials to be evaluated. The burning of the product after removal of the flame is noted.

#### **H.2 Apparatus and materials**

**H.2.1 Five panels**, Each measuring 200 mm x 250 mm x 0.71 mm, of hard aluminium

**H.2.2 Glass beaker**, nominal capacity 150 ml

**H.2.3 Stop-watch**

**H.2.4 Flat brush**, 25 mm

#### **H.3 Procedure**

**H.3.1** Degrease five test panels of hard aluminium (H.2.1) in accordance with 5.2 of BS EN 605.

**H.3.2** Pour a quantity of the product to be tested into the beaker (H.2.2). Using a flat brush (H.2.4), apply  $109 \pm 59$  of the paint remover evenly to each panel. Determine the mass applied by weighing the beaker, its contents and the brush immediately before and after the application.

**H.3.3** Place the coated panels horizontally and maintain at a temperature of  $23\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$  and a relative humidity of  $(50 \pm 5)\%$ . In a draught-free environment, carry out the procedure given in H.3.4 on successive test panels at the following intervals after application:

- a) immediately;
- b) 15 min;
- c) 30 min;
- d) 60 min;
- e) 120 min.

**H.3.4** Support the panel horizontally with the paint-remover coating uppermost. Using a Bunsen burner adjusted to give a 25 mm blue flame, direct the flame (at an angle of  $45^{\circ}$ ) at the centre of the panel for 5 s. Remove the flame and observe the effect on the product.

#### **H.4 Expression of results**

Record, for each time interval, whether, after removal of the flame, there is any local burning and whether the burning ceases within 2 s.

## **H.5 Report**

The product shall not burn over the whole surface of any of the test panels and shall not burn for more than 2 s after removal of the flame following any of the five applications

## Annex J (normative)

### Determination of phenols in paint and varnish remover

#### J.1 Scope

This method may be used to determine phenols and cresols in water-rinsable dichloromethane-based paint and varnish removers. Some substituted phenols such as trichlorophenol cannot be detected using this method.

#### J.2 Principle

Phenols are recovered from the paint and varnish remover by steam distillation under acid conditions. After removing the dichloromethane from the distillate, an excess of iodine solution is added. After the reaction is completed in the presence of sodium hydrogen carbonate, the mixture is acidified and the excess iodine is determined by titration with sodium thiosulfate.

#### J.3 Reagents

The reagents used should be of recognized analytical reagent quality.

**J.3.1 Hydrochloric acid**,  $c(\text{HCl}) = 5 \text{ mol/l}$ . Add cautiously, with stirring, 50 ml of concentrated hydrochloric acid to 50 ml of water.

**J.3.2 Sulfuric acid**,  $c(\text{H}_2\text{SO}_4) = 0.5 \text{ mol/l}$ . Continuously add, with stirring and cooling, 14 ml of concentrated sulfuric acid ( $\rho(20^\circ\text{C}) = 1.84 \text{ g/cm}^3$ ) to 400 ml of water. Cool and dilute to 500 ml with water.

**J.3.3 Sodium hydrogen carbonate solution**, 10 g/l. Dissolve 1 g of sodium hydrogen carbonate in 100 ml of water.

**J.3.4 Iodine solution**,  $c(\text{I}_2) = 0.05 \text{ mol/l}$ . Dissolve 20 g of potassium iodide in 30 ml to 40 ml of water contained in a one mark 1 graduated flask and add 12.7 g of iodine. Shake the flask until all the iodine has dissolved, dilute to the mark with water and mix thoroughly.

Commercially prepared iodine solutions,  $c(\text{I}_2) = 0.05 \text{ mol/l}$ , are available and may be used for this determination.

**J.3.5 Sodium thiosulfate standard solution**,  $c(\text{Na}_2\text{S}_2\text{O}_3) = 0.1 \text{ mol/l}$ .

**J.3.6 Starch indicator**, 5 g/l. Suspend 0.5 g of soluble starch in 100 ml of water and heat to boiling with constant stirring. Allow the solution to cool.

#### J.4 Apparatus

**J.4.1 Ordinary laboratory apparatus**

**J.4.2 Steam generator**

**J.4.3 Splash head and steam delivery tube**

**J.4.4 Round-bottomed flask**, of 500-ml capacity

**J.4.5 Water-cooled condenser**, of 400 mm effective length

**J.4.6 Iodine flasks**, of 500-ml capacity

**J.4.7 Pipette**, one mark, of 25-ml capacity

**J.4.8 Burette**, of 50-ml capacity

## J.5 Procedure

**J.5.1** Weigh **10 g  $\pm$  0.01 g** of the paint remover (*W*) into the 500-ml round-bottomed flask (J.4.4).

**J.5.2** Add 100 ml of water, 5 ml of hydrochloric acid,  $c(\text{HCl}) = 5 \text{ mol/l}$ , and a few anti bumping granules. Assemble the steam distillation apparatus and, using the 500 ml iodine flask as a receiver, collect not less than 100 cm<sup>3</sup> of steam distillate.

**J.5.3** Rinse the condenser and distillate delivery tube with water combining the rinsings in the iodine flask.

**J.5.4** Add a few anti bumping granules to the iodine flask and warm it on a steam bath until all the globules of dichloromethane have boiled away.

**J.5.5** Cool the contents of the flask to 22 °C to 25 °C and, by means of pipette, add 25.00 ml of the iodine solution,  $c(\text{I}_2) = 0.05 \text{ mol/l}$ . Add immediately, 25 ml of sodium hydrogen carbonate solution, insert the stopper and mix the flask contents thoroughly.

**J.5.6** After 20 min, add 5 ml of sulfuric acid,  $c(\text{H}_2\text{SO}_4) = 0.05 \text{ mol/l}$ , and titrate the contents of the flask with sodium thiosulfate solution (*TV*,  $c(\text{Na}_2\text{S}_2\text{O}_3) = 0.01 \text{ mol/l}$ , adding the starch indicator as the end-point is approached.

**J.5.7** When ortho-cresol is present in the distillate, the iodide formed is pale orange.

**J.5.8** Thus for ortho-cresol the colour change at the end-point may be from brownish green to orange, whereas, for all other phenols, the colour change is from green through blue to white.

**J.5.9** Carry out a blank titration ( $T_2$ ) substituting 100 ml of water for the distillate. There is no need to allow 20 min to elapse between adding the sodium hydrogen carbonate solution and adding the sulfuric acid.

## J.6 Calculating and reporting

Calculate the phenols content and report to the nearest 0.01 % (*m/m*) as phenol using the formula:

$$\frac{(T_2 - T_1) \times 0.157 \times F}{W}$$

where

$T_1$  is the titration for the sample (in ml);

$T_2$  is the titration for the blank (in ml);

$W$  is the mass to the nearest 0.01 g of the sample (in g);

$F$  is the correction factor for the sodium thiosulfate,  $c(\text{Na}_2\text{S}_2\text{O}_3) = 0.1 \text{ mol/l}$ .



**Bibliography**

*KS 1831:2005, Hot applied Thermoplastic Road Marking paint — Specification Part 2: Specification for road performance*

