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"जानने का अधिकार, जीने का अधिकार"  
Mazdoor Kisan Shakti Sangathan  
"The Right to Information, The Right to Live"

"पुराने को छोड़ नये के तरफ"  
Jawaharlal Nehru  
"Step Out From the Old to the New"

AMENDMENT NO. 3 JUNE 2011
TO
IS 873 : 1974 SPECIFICATION FOR
LIQUID GLUCOSE
(First Revision)

[Page 6, clause 5.2(f)] — Substitute ‘Net quantity’ for ‘Net mass’.

[Page 6, clause 5.2(h) (see also Amendment No. 2)] — Substitute the following for the existing:

‘Any other requirements as given under the Standards of Weights and Measures (Packaged Commodities) Rules, 1977 and the Prevention of Food Adulteration Act, 1955 and the Rules framed thereunder.’

[Page 6, clause 5.2.1, line 9] — Substitute ‘Net quantity’ for ‘Net mass’.

Reprography Unit, BIS, New Delhi, India
Indian Standard
SPECIFICATION FOR
LIQUID GLUCOSE
(First Revision)

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Tapioca Market Expansion Board, Government of Kerala, Trivandrum
Central Food Technological Research Institute (CSIR), Mysore
Ravalgaon Sugar Farm Ltd, Ravalgaon

(Continued on page 2)
(Continued from page 1)

<table>
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<th>Members</th>
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<tr>
<td>SHERI A. S. RAJADHYAKSHA</td>
<td>Corn Products Co (India) Private Limited, Bombay</td>
</tr>
<tr>
<td>SHERI S. R. PALMEKAR (Alternate)</td>
<td></td>
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</tr>
<tr>
<td>Director (Agri &amp; Food)</td>
<td></td>
</tr>
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</table>

Secretary

SHERI G. S. VILEMU
Deputy Director (Agri & Food), ISI
AMENDMENT NO. 2 NOVEMBER 1995
TO
IS 873 : 1974 SPECIFICATION FOR LIQUID GLUCOSE
(First Revision)

(Page 3, clause 0.2, last sentence) — Substitute the following for the existing:
'It may be manufactured by acid or enzyme hydrolysis of starch. The source of starch materials generally used include tapioca, corn and rice.'

(Page 3, clause 0.5, line 3) — Add 'and the Standards of Weights and Measures (Packaged Commodities) Rules, 1977' after the word 'thereunder'.

(Page 4, clause 2.1, line 4) — Add 'acid or enzyme' before the word 'hydrolysis'.

(Page 4, clause 4.1, line 2) — Substitute the following for the existing:
'It shall be clear, free from fermentation, mouldy growth, sediment, dirt or other suspended and extraneous matter, or added sweetening or flavouring agents or any other deleterious substances.'

(Page 5, Table 1) — Substitute the following for the existing:

<table>
<thead>
<tr>
<th>TABLE 1 REQUIREMENTS FOR LIQUID GLUCOSE (ALL GRADES)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SL NO.</strong></td>
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<tr>
<td>-----------</td>
</tr>
<tr>
<td>(1)</td>
</tr>
<tr>
<td>i)</td>
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<tr>
<td>ii)</td>
</tr>
<tr>
<td>iii)</td>
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<td>iv)</td>
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<td></td>
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<td>v)</td>
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<tr>
<td>vi)</td>
</tr>
<tr>
<td>vii)</td>
</tr>
</tbody>
</table>

1
TABLE 1 (Concluded)  

<table>
<thead>
<tr>
<th>SL No.</th>
<th>CHARACTERISTIC</th>
<th>REQUIREMENT</th>
<th>METHOD OF TEST, REF TO</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td></td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>viii)</td>
<td>*Escherchia Coli, in 20 g</td>
<td>Absent</td>
<td>IS 5887 (Part 1) : 1976‡</td>
</tr>
<tr>
<td>ix)</td>
<td>*Salmonella, in 20 g</td>
<td>Absent</td>
<td>IS 5887 (Part 3) : 1976‡</td>
</tr>
</tbody>
</table>

*Methods of test for edible starches and starch products: Part 2 Chemical methods (first revision).  
†Methods of sampling and analysis for sugar confectionery (first revision).  
‡Methods of detection of bacteria responsible for food poisoning: Part 1 Isolation, identification and enumeration of *Escherchia Coli* (first revision).  
§Methods of detection of bacteria responsible for food poisoning: Part 3 Isolation and identification of *Salmonella* and *shigella* (first revision).

[Page 6, clause 5.2(c)] — Substitute the following for the existing:

'c) Name and address of manufacturer,'.

(Page 6, clause 5.2) — Add the following at the end:

‘g) Date of expiry;

b) Any other details required under the *Standards of Weights and Measures (Packaged Commodities) Rules, 1977*.’

(Page 6, clause 5.2.2) — Substitute the following for the existing:

‘5.3 BIS Certification Marking

The product may also be marked with the Standard Mark.

NOTE — The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standards Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which a licence for the use of Standard Mark may be granted to manufacturers or processors may be obtained from the Bureau of Indian Standards.’


(Page 6, foot-note with ‘*’ mark) — Substitute the following for the existing title:

‘*Reagent grade water (third revision).’

(Page 7, clause A-2.1, line 2) — Delete the words ‘of the Regular Conversion grade material’.

(FAD 2)
Indian Standard

SPECIFICATION FOR LIQUID GLUCOSE

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 11 March 1974, after the draft finalized by the Edible Starches and Glucose Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 Liquid glucose is extensively used in confectionery, biscuit and food canning industries. To a limited extent, it also finds use in textile, leather and paper industries. It is, at present, manufactured in the country by the 'acid hydrolysis' of starch.

0.3 This standard was first published in 1956. The various provisions of that standard had been under the review of the Sectional Committee responsible for the preparation of this standard, and the present revision based on the experience gained both by manufacturers and users, is being issued. This revision incorporates a number of important modifications, namely, (a) number of grades has been increased from three to five incorporating additional grades of regular and extra high conversions; (b) the requirements of total solids, sulphated ash, iron, zinc and tin have been deleted; (c) the additional requirements of total solids, dextrose equivalent (DE; value have been included; and (d) the limit for ash has been lowered.

0.4 This standard stipulates the use of a 2.54-cm cell in Lovibond Tintometer for determining the colour of liquid glucose. While realizing that measuring colour in 10-cm and 15-cm cells would make colour determination more accurate and precise, the Sectional Committee, for want of data, decided not to make any change in the Indian Standard at this juncture. However, the Committee recommended that comparative data using different sizes of cells in determining colour of liquid glucose should be collected, and if in the light of these results it was found necessary, the Indian Standard should be modified.

0.5 In the preparation of this standard due consideration has been given to the Prevention of Food Adulteration Act, 1954 and the Rules framed thereunder. However, this standard is subject to the restrictions imposed under these, wherever applicable.
0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE
1.1 This standard prescribes the requirements and the methods of sampling and test for liquid glucose.

2. TERMINOLOGY
2.1 For the purpose of this standard, liquid glucose or glucose syrup shall mean a refined and concentrated non-crystallizable aqueous solution of d-glucose, maltose and other polymers of d-glucose, obtained by controlled hydrolysis of starch containing material.

3. GRADES
3.1 The material shall be of the following five grades:
   a) Low conversion (LC),
   b) Regular conversion (RC),
   c) Intermediate conversion (IC),
   d) High conversion (HC), and
   e) Extra high conversion (EHC).

4. REQUIREMENTS
4.1 The material shall be in the form of an odourless and viscous syrup with a characteristic sweet taste. It shall be clear, free from fermentation, mouldy growth, sediment, dirt or other suspended and extraneous matter, or added sweetening and flavouring agents.

4.2 Colour — When a 50 percent (m/v) solution of the material of regular conversion grade is tested in a Lovibond Tintometer in a 2.54-cm cell by the method prescribed in Appendix A, the colour of the material in terms of Lovibond units shall not be deeper than:
   a) 0.1 yellow and 0.1 red within a period of 90 days from the date of manufacture, and
   b) 0.2 yellow and 0.1 red within a period of 180 days from the date of manufacture.

*Rules for rounding off numerical values (revised).
4.3 When determined according to the method prescribed in Appendix B, the dextrose equivalent (DE) value for different grades shall be as follows:

- **Low conversion (LC)**: 28 to 37
- **Regular conversion (RC)**: 38 to 47
- **Intermediate conversion (LC)**: 48 to 57
- **High conversion (HC)**: 38 to 67
- **Extra high conversion (EHC)**: 68 and above

4.4 The material shall also comply with the requirements given in Table 1.

**TABLE 1 REQUIREMENTS FOR LIQUID GLUCOSE (ALL GRADES)**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Characteristic</th>
<th>Requirement</th>
<th>Method of Test, Ref to Appendix CI No. of IS : 4706-1968*</th>
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<td>(1)</td>
<td>(2)</td>
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<td>(4)</td>
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<tr>
<td>i)</td>
<td>Total solids, percent by mass, <em>Min</em></td>
<td>80</td>
<td>C</td>
</tr>
<tr>
<td>ii)</td>
<td>Ash, percent by mass, <em>Max</em></td>
<td>0.3</td>
<td>—</td>
</tr>
<tr>
<td>iii)</td>
<td><em>pH</em></td>
<td>4.8 to 5.5</td>
<td>—</td>
</tr>
<tr>
<td>iv)</td>
<td>Sulphur dioxide, ppm, <em>Max</em></td>
<td>400</td>
<td>—</td>
</tr>
<tr>
<td>v)</td>
<td>Arsenic, ppm, <em>Max</em></td>
<td>1.0</td>
<td>D</td>
</tr>
<tr>
<td>vi)</td>
<td>Copper, ppm, <em>Max</em></td>
<td>5</td>
<td>E</td>
</tr>
<tr>
<td>vii)</td>
<td>Lead, ppm, <em>Max</em></td>
<td>2</td>
<td>F</td>
</tr>
</tbody>
</table>

*Methods of test for edible starches.

5. PACKING AND MARKING

5.1 Packing — The material shall be packed in dry and leak-proof containers. Unless otherwise agreed between the purchaser and the vendor, such containers may be either lacquered or lined steel drums, or made of tin plates.

5.2 Marking — The containers shall be suitably marked with the following information:

a) Liquid glucose,

b) Grade of the material,
c) Name of the manufacturer,
d) Date of manufacture,
e) Batch or code number, and
f) Net mass of the contents.

5.2.1 The words ‘liquid glucose’ [see 5.2 (a)] shall be marked in sufficiently bold letters as compared with other particulars:

*Example:*

**LIQUID GLUCOSE**

Intermediate Conversion
XYZ & Co
20 Mar 1974
Batch No. 593
Net mass — 25 kg

5.2.2 The product may also be marked with Standard mark.

5.2.3 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6. SAMPLING

6.1 The method of drawing representative samples of the material and the criteria for conformity shall be as given in Appendix G.

7. TESTS

7.1 The tests shall be carried out as prescribed in 4.2, 4.3 and col 4 and 5 of Table 1.

7.2 Quality of Reagents — Unless specified otherwise, pure chemicals and distilled water (*see IS : 1070-1960*) shall be employed in tests.

*Note — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the results of analysis.

*Specification for water, distilled quality (revised).*
APPENDIX A
(Clause 4.2)

DETERMINATION OF COLOUR

A-0. GENERAL

A-0.1 This method determines the colour of a 50 percent (m/v) solution of the material in water, by comparison with Lovibond glasses of known colour characteristics.

A-1. APPARATUS

A-1.1 Lovibond Tintometer

A-1.2 Glass Cell — 2.54-cm, made of clear, colourless glass.

A-2. PROCEDURE

A-2.1 Preparation of the Solution — Prepare a 50 percent (m/v) solution of the Regular Conversion grade material in water.

A-2.2 Clean the 2.54-cm glass cell with carbon tetrachloride to remove any oily or greasy film on it, and allow it to dry. Fill the cell with the prepared solution (see A-2.1) and place it in position in the Tintometer. Place along side of it such red and/or yellow Lovibond glasses as are necessary to match the colour shade of the prepared solution, observing the colours of the prepared solution and of the combination of Lovibond glasses through the eye-piece.

A-3. REPORT

A-3.1 Report the colour of the prepared solution (containing 50 percent m/v of the material) in terms of Lovibond units by summing up individually the values for the red and yellow Lovibond glasses as follows:

\[
\text{Colour reading of a 50 percent (m/v) solution of the material in water, in 2.54-cm cell on the Lovibond scale} = aY + bR
\]

where

\( a = \) the sum total of the various yellow (Y) Lovibond glasses used, and

\( b = \) the sum total of the various red (R) Lovibond glasses used.
APPENDIX B  
(Clause 4.3)

DETERMINATION OF DEXTROSE EQUIVALENT VALUE

B-1. PRINCIPLE

B-1.1 Titration of the sugar solution with Fehling’s solution at boiling point using methylene blue as indicator. The volumes of the solutions are adjusted in such a way that the total volume at the end of the titration has a given value (75 ± 5 ml).

B-2. REAGENTS

B-2.1 Fehling’s Solution

Solution A — Aqueous solution of copper sulphate containing 69·28 g of CuSO₄. 5H₂O per litre.

Solution B — Aqueous solution containing 346 g of sodium potassium tartrate, potassium tetrahydrate and 100 g of sodium hydroxide per litre.

Note — As the mixed solutions are unstable in the presence of air, mixing is done during the test.

B-2.1.1 Calibration of the Fehling’s Solution — Titrate the Fehling’s solution thus prepared with the standard solution of dextrose (B-2.2) as indicated in B-4.2. Let $V_0$ be the number of millilitres of dextrose solution used; this value should be equal to 40 ± 0·5 ml. Otherwise, the Fehling’s solution should be adjusted.

B-2.2 Standard Solution of Dextrose — Dissolve 2·5 g of the pure dextrose dried beforehand at 70°C under reduced pressure, in distilled water to make 1000 ml.

B-2.3 Methylene Blue Indicator — One percent aqueous solution.

B-3. APPARATUS

B-3.1 Ordinary laboratory equipment.

B-3.1.1 Volumetric Flask — 500 ml.

B-3.1.2 Single Mark Pipette — 10 ml.

B-3.1.3 Analytical Balance

B-3.1.4 Chronometer

B-3.2 Apparatus consisting of the following parts.
B-3.2.1 Conical Flask with a Narrow Mouth — 300 ml.

B-3.2.2 Burette with Stopper or Bent Burette — 50 ml graduated in 0.1 ml and suitable protection plate.

B-3.2.3 A Heating Device — which would ensure boiling under the conditions indicated in B-4 and which would enable lighting, to determine the end point without having to move the conical flask.

B-4. PROCEDURE

B-4.1 Test Portion — Weigh to the nearest 0.001 g a quantity of sample in such a way that after dilution to 500 ml, the test solution contains approximately 0.25 g of reducing sugars expressed as dextrose for 100 ml. (This test portion generally weighs between 1 and 10 g.)

B-4.2 Determination — With the help of the pipette, transfer 10 ml each of solutions A and B of the Fehling's solution into the 300-ml conical flask. Add a boiling regulator, that is, pumice stone or glass marbles and enough of water to raise the total volume of the liquid (Fehling's solution + water + test solution) to 75 ml ± 5 ml at the end of the titration. In order to determine the quantity of water that is added, it is often necessary to carry out a preliminary determination using the quantity of water, considered effective for covering evaporation, for instance 40 ml. Put the conical flask on the heating device. Right from the start of heating, pour with the help of the burette the sugar solution amounting within 0.5 ml of the anticipated end point (determined by a preliminary test in which the test solution is gradually added till the end point is reached). Adjust the heating in such a way as to make the solution boil within 2.75 ± 0.25 min and then make no more adjustment till the end of the test. The boiling should be brisk and continuous all along the operation otherwise air would enter the flask and oxidize its contents. It is therefore essential that the flask is not shaken after the heating starts. After 2 minutes of boiling, add 2 drops of methylene blue solution and complete the titration drop by drop. At the approach of the end point, observe a time of ten to fifteen seconds between the addition of two successive drops. Carry out the operation till the blue colour vanishes. Titration should be completed within 1.5 to 2.0 min after the addition of the indicator.

B-4.2.1 Let \( V_i \) be the number of millilitres of test solution used. If this volume is not 40 ± 5 ml, it is necessary to modify the concentration of the test solution. It is recommended to check at the end of the titration if the final volume falls within the prescribed limits. Carry out two determinations on the same sample.
B-5. EXPRESSION OF RESULTS

B-5.1 The reducing sugar expressed as dextrose, percent by mass, is equal to:

\[
\frac{2.5}{1000} \times \frac{V_0}{V_1} \times \frac{500}{E} \times \frac{100}{V_1} = \frac{125 V_0}{V_1 \times E}
\]

where

- \( E \) = mass, in g, of the test portion;
- \( V_0 \) = volume, in ml, of the standard dextrose solution (B-2.2) used for the calibration of the Fehling's solution; and
- \( V_1 \) = volume, in ml, of the test solution required for reducing 20 ml of the Fehling's solution.

APPENDIX C

[ Table 1, Item (i) ]

DETERMINATION OF TOTAL SOLIDS

C-1. EQUIPMENT AND APPARATUS

C-1.0 The following equipment and apparatus are required.

C-1.1 Diatomaceous Earth — Neutral to litmus when moistened with water. [If a commercial grade is used, wash it by percolation with water which has been slightly acidulated with hydrochloric acid, until the effluent is acidic to litmus. Then rewash with water (not acidulated), until the effluent is neutral to litmus. Finally dry the earth in an oven at about 105°C.]

C-1.2 Glass Stirring Rod — approximately 60-mm long with a flattened end.

C-1.3 Moisture Dish — with a cover made of aluminium; approximately 25 mm in height and 75 mm in diameter.

C-1.4 Desiccator — containing phosphorus pentoxide as desiccant.

C-1.5 Nickel Scoop

C-1.6 Vacuum Oven
C-2. PROCEDURE

C-2.1 Place about 10 g of the diatomaceous earth and the glass stirring rod in the moisture dish and dry the diatomaceous earth in an air oven at about 105°C. Cool in the desiccator and weigh. Repeat drying in the air oven, cooling in the desiccator and weighing till the mass is constant. Note the combined mass of the dish with the cover, the glass stirring rod and the dry diatomaceous earth. Weigh accurately about 5 g of the material in the nickel scoop, mix it with 5 ml of water and run on to the diatomaceous earth, using the glass stirring rod. Wash the scoop thrice, using 2 ml of water for each washing and transfer the washings on to diatomaceous earth, simultaneously working the contents of the moisture dish into a thick paste using the glass stirring rod. Leave the glass stirring rod in the dish. Place the moisture dish in the vacuum oven and dry the contents of dish at 100°C. Cool the dish and its contents in the desiccator and weigh. Repeat drying in the vacuum oven cooling in the desiccator and weighing till the mass is constant.

C-3. CALCULATION

Total solids content, percent by mass = 100 - \[
\frac{100 (M + A - B)}{M}
\]

where

- \(M\) = mass in g of the material taken for the test;
- \(A\) = mass in g of the moisture dish containing the glass stirring rod and dried diatomaceous earth; and
- \(B\) = mass in g of the moisture dish containing the glass stirring rod, diatomaceous earth and the dehydrated material.

APPENDIX D

[Table 1, Item (v)]

DETERMINATION OF ARSENIC

D-1. APPARATUS

D-1.0 The following apparatus assembled as shown in Fig. 1 is required.

D-1.1 Wide Mouth Bottle — 120 ml.
D-1.2 Glass Tube — made from ordinary glass tubing, and having a total length of 200 mm. It has an internal diameter of exactly 6.5 mm and an external diameter of about 8 mm. It is drawn out at one end to a diameter of about one millimetre and a hole not less than 2 mm in diameter is blown in the side of the tube, near the constricted part. The upper end of the tube is cut off square and is either rounded off slightly or ground smooth.

![Diagram of apparatus for the determination of arsenic](image)

**Fig. 1 Assembly of apparatus for the determination of arsenic**
D-1.3 Rubber Bungs — three. One fits exactly into the mouth of the wide mouth bottle and has a hole bored centrally to take the tube from its constricted end. Each of the other two rubber bungs (about 25 × 25 mm) has a hole, exactly 6·5 mm in diameter, bored centrally and is fitted with a rubber band or spring clip for holding them tightly together.

D-1.4 Preparation of the Glass Tube — Moisten a small quantity of cotton wool with lead acetate solution (see D-2.1) and then dry it in a dust-free atmosphere. Lightly pack the glass tube with this cotton wool, so that the upper surface of the cotton wool is not less than 25 mm below the top of the tube. Insert the upper end of the tube into the narrow end of one of the pair of rubber bungs (about 25 × 25 mm size) either to a depth of about 10 mm (when the tube has a rounded off end) or so that the ground end of the tube is flush with the larger end of the bung. Place a piece of mercuric chloride paper (see D-2.2) flat on the top of the bung. Place the other bung over this with its larger end in contact with the piece of mercuric chloride paper. Fasten the two bungs by means of the rubber band or the spring clip, in such a manner that the borings of the two bungs (or the upper bung and the glass tube) meet to form a true tube of 6·5 mm diameter interrupted by a diaphragm of mercuric chloride paper.

D-1.4.1 Instead of this method of attaching the mercuric chloride paper, any other method may be used, provided that: (a) the whole of the evolved gas passes through the paper; (b) the portion of the paper in contact with the gas is a circle of 6·5 mm diameter; and (c) the paper is protected from sunlight during the test.

D-2. REAGENTS

D-2.0 The following reagents are required. (The reagents with the exception of D-2.10 and D-2.11 shall be free from traces of arsenic.)

D-2.1 Lead Acetate Solution — 10·0 percent (m/v) in water, recently boiled and cooled.

D-2.2 Mercuric Chloride Paper — smooth white filter paper, not less than 25 mm in width, soaked in a saturated solution of mercuric chloride in water; pressed to remove superfluous solution, and dried at about 60°C in the dark. The grade of the filter paper shall be such that the mass in g/m² shall be between 65 and 120; the thickness in mm of 400 papers shall be approximately equal, numerically, to the mass in g/m². Mercuric chloride paper should be stored in a stoppered bottle in the dark. Papers which have been exposed to sunlight or to the vapour of ammonia should not be used as they give lighter coloured stains or no stain at all when employed in the quantitative test for arsenic.
D-2.3 Bromine Solution — Add to a small quantity of water 30 g of potassium bromide. Dissolve the potassium bromide in the water and mix with it 30 g of bromine. Dilute with water to produce 100 ml and mix.

D-2.4 Concentrated Hydrochloric Acid — sp gr 1·16 and complying with the following test:

Dilute 10 ml of the concentrated hydrochloric acid with sufficient water to produce 50 ml, add 5 ml of ammonium thiocyanate solution [10 percent (m/v) in water] and stir immediately. No colour shall be produced.

D-2.5 Brominated Hydrochloric Acid — Mix together one millilitre of bromine solution and 100 ml of concentrated hydrochloric acid.

D-2.6 Stannous Chloride Solution — Dilute 60 ml of concentrated hydrochloric acid with 20 ml of water, add to it 20 g of tin, heat gently until gas ceases to evolve, and add sufficient water to produce 100 ml, allowing the undissolved tin to remain in the solution. Decant the clear solution, add an equal volume of concentrated hydrochloric acid, boil down to the original volume and filter through a fine-grained filter paper.

D-2.7 Potassium Iodide — crystals or powder.

D-2.8 Zinc — granulated and complying with the following test:

Take 50 ml of water, 10 ml of stannated hydrochloric acid (see D-2.9) and 0·1 ml of dilute solution of arsenic (see D-2.11) in the wide mouth bottle. Add one gram of potassium iodide and 10 g of zinc. Quickly place the prepared glass tube (see D-1.4) in position. Allow the reaction to continue for one hour. A faint but distinct yellow stain shall be produced on the mercuric chloride paper.

D-2.9 Stannated Hydrochloric Acid — Mix together one millilitre of stannous chloride solution and 100 ml of concentrated hydrochloric acid.

D-2.10 Strong Solution of Arsenic — Dissolve 0·132 g of arsenic trioxide in 50 ml of concentrated hydrochloric acid, add sufficient water to produce 100 ml and mix.

D-2.11 Dilute Solution of Arsenic — freshly prepared. Dilute one millilitre of strong solution of arsenic with water sufficient to produce 100 ml. This solution contains 0·01 mg of arsenic (or 0·013 2 mg of As₂O₃) per ml.

D-3. PROCEDURE

D-3.1 Preparation of the Solution — Weigh accurately 10 g of the material, dissolve it in 50 ml of water, and add to it 10 ml of brominated
hydrochloric acid. Allow the solution to stand for five minutes and remove the excess of bromine with a few drops of stannous chloride solution.

D-3.2 Place the whole of the prepared solution (see D-3.1) in the wide mouth bottle and add one gram of potassium iodide and 10 g of zinc. Quickly place the prepared glass tube (see D-1.4) in position. Allow the reaction to continue for 40 minutes (see also Note under D-3.2.3). Remove the piece of mercuric chloride paper at the end of this period. Compare the yellow stain, produced on the mercuric chloride paper if arsenic is present in the material, by day light with the standard stain prepared as described under D-3.3.

D-3.2.1 The limit prescribed in Table 1 shall be taken as not having been exceeded if the stain produced by operating the material is not deeper than the standard stain (see D-3.3).

D-3.2.2 Comparison of Stains — The comparison of the stains is made with freshly prepared stain immediately at the completion of the test.

D-3.2.3 A blank determination shall be carried out under the same conditions, on the same reagents [used both in the preparation of the solution (see D-3.1) and in the test (see D-3.2)] and by the same person but without using the material. The blank shall not produce any visible stain on the mercuric chloride paper.

Norm — The reaction may be accelerated by placing the apparatus on a warm surface, care being taken that the mercuric chloride paper remains quite dry throughout the test. The most suitable temperature for carrying out the test is generally about 40°C, but because the rate of evolution of the gas varies somewhat with different batches of zinc, the temperature may be adjusted to obtain a regular but not too violent, evolution of gas. The glass tube should be washed with concentrated hydrochloric acid, rinsed with water, and dried between successive tests.

D-3.3 Preparation of Standard Stain — Mix together 50 ml of water, 10 ml of stannated hydrochloric acid and one millilitre of dilute solution of arsenic. Treat the resulting solution as described under D-3.2 to prepare the standard stain.

APPENDIX E
[Table 1, Item (vi)]
DETERMINATION OF COPPER

E-1. REAGENTS

E-1.1 Ammonium Hydroxide — concentrated.
E-1.2 Carbon Tetrachloride — redistilled before use.

E-1.3 Masking Solution — Dissolve 200 g of reagent grade ammonium citrate and 50 g of reagent grade disodium salt of ethylenediamine tetra-acetic acid (Vorsene) in distilled water in a one-litre volumetric flask. Dilute to volume with distilled water and mix thoroughly.

E-1.4 Standard Copper Solutions

E-1.4.1 Stock Solution — Transfer quantitatively 0.2015 g of reagent grade anhydrous copper sulphate (CuSO₄) to a one-litre volumetric flask. Dilute to volume with distilled water and mix thoroughly.

E-1.4.2 Standard Dilute Solution — 2 μg/ml. Pipette 25.0 ml of stock solution into a one-litre volumetric flask; dilute to volume with distilled water and mix thoroughly. Prepare freshly.

E-1.5 Cresol Red Indicator — 0.1 percent solution.

E-1.6 Carbamate Reagent — 0.1 percent solution. Dissolve 0.2 g of sodium diethyl-dithiocarbamate in distilled water, dilute to 200 ml volume and mix thoroughly. Filter, if the solution is hazy. Prepare fresh daily.

E-2. PROCEDURE

E-2.1 Weigh accurately 2 g of the sample and transfer to a 250-ml separating funnel. Add distilled water to make a total volume of 25 ml; add 10 ml of masking solution and 2 drops of indicator and mix. Neutralize to purple colour with concentrated ammonium hydroxide and add 2 drops in excess. Add 10 ml of carbamate reagent and mix. Extract with 5-ml portions of carbon tetrachloride until the final extract is colourless (four extractions are usually adequate). Dry the combined extracts with reagent grade anhydrous sodium sulphate. Filter the dry extract and wash the filter paper with carbon tetrachloride. Make the volume of the filtrate to 25 ml with carbon tetrachloride and measure the absorption at 433 nm in 10-mm cell. Simultaneously, carry out blank determinations on water and the reagents. Extract with 5-ml portions of carbontetrachloride, and dilute combined extracts to 25 ml with CCl₄; the colour of the solution is not deeper than that of the carbontetrachloride extracts derived from 5-ml of standard solution, when similarly treated.

E-2.2 Prepare a series of standards by treating aliquots of the standard dilute solution (E-1.4.2) of copper in the same manner as the test solution. From the absorption of the standard solutions, prepare a standard curve plotting absorption values against concentration. From this curve, obtain the mass of copper.
APPENDIX F

[Table 1, Item (vii)]

DETERMINATION OF LEAD

F-1. REAGENTS — All reagents should be free from lead.

F-1.1 Hydrochloric Acid — 32 percent m/w.

F-1.2 Bromothymol Blue Solution — Warm 0.1 g of bromothymol blue with 3.2 ml of N/20 sodium hydroxide and 5 ml of alcohol (90 percent); after solution is effected, and sufficient alcohol (20 percent) to produce 250 ml.

F-1.3 Ammonia Solution, Strong — contains not less than 27 percent m/m and not more than 30 percent m/m of NH₃.

F-1.4 25 Percent Citric Acid Solution Adjusted to 11.0 pH — Dissolve 25 g citric acid in minimum quantity of water, cool and slowly add strong ammonia solution to adjust 11 pH and make total volume to 100 ml.

F-1.5 Potassium Cyanide Solution — Dissolve 10 g of potassium cyanide in 90 ml of water, add 2 ml of hydrogen peroxide solution (6 percent m/v of H₂O₂). Allow to stand for twenty four hours, and make up to 100 ml with water. Mix 2 ml with 5 ml of ammonia solution Pt; no darkening is produced.

F-1.6 Diphenylthiocarbazone in Chloroform — 0.002 percent m/v.

F-1.7 Nitric Acid Solution — 1 percent v/v, prepared by diluting 1 ml of concentrated nitric acid (69 to 71 percent m/m HNO₃) to 100 ml with water.

F-1.8 Ammonium Citrate Solution — Dissolve with cooling, 500 g of citric acid in a mixture of 200 ml of water and 200 ml of strong ammonia solution. Filter and add sufficient water to produce 1 000 ml.

F-1.9 Lead Solution, Strong — Dissolve 0.16 g lead nitrate in 5 ml of concentrated nitric acid (69 to 71 percent m/v HNO₃) and add sufficient water to produce 100 ml.

F-1.10 Lead Solution, Dilute — Dilute 1 ml of strong lead solution with sufficient water to produce 100 ml.

F-2. PROCEDURE

F-2.1 Dissolve 10 g of the material in 20 ml of water, transfer to a separating funnel with the aid of 5 ml of water, add 2.5 ml of hydrochloric
acid and shake for five minutes. Add 5 drops of bromothymol blue solution and sufficient strong ammonia solution to produce a full blue colour and add 1·5 ml in excess. Add 1 ml of a solution prepared by previously adjusting a 25 percent m/v solution of citric acid to pH 11 with strong ammonia solution, 1 ml of potassium cyanide solution and sufficient of a 0·002 percent m/v solution of diphenylthiocarbazone in chloroform until on shaking, the chloroform layer becomes purple or blue. Separate the chloroform layer and add to the aqueous layer 2 ml of the diphenylthiocarbazone solution, shake and separate the chloroform layer. To the combined chloroform solutions add 10 ml of a 1 percent (v/v) solution of nitric acid, shake until the chloroform layer becomes green, allow to separate and discard the chloroform layer. To the aqueous layer add 0·2 ml of the ammonium citrate solution, 0·25 ml of strong ammonia solution and 0·2 ml of potassium cyanide solution and sufficient of the diphenylthiocarbazone solution until on shaking, the chloroform layer becomes purple or blue. Transfer the contents of the separating funnel to a stoppered tube. Repeat the operations omitting the substance under examination and using the same quantities of the reagents. To the tube containing the blank, add dilute lead solution until on shaking, the colour of the chloroform layer matches that of the chloroform layer obtained from the substance under examination. Not more than 2·0 ml of dilute lead solution is required. The limit prescribed in the material specification shall be taken as not having been exceeded if the intensity of its colour produced in the test with the material is not more than the one produced with the corresponding lead solution.

APPENDIX G
(Clause 6.1)
SAMPLING OF LIQUID GLUCOSE

G-1. GENERAL REQUIREMENTS FOR SAMPLING

G-1.0 In drawing, preparing, storing and handling samples, the following precautions and directions shall be observed.

G-1.1 Sampling instrument shall be clean and dry when used.

G-1.2 Precautions shall be taken to draw the samples in a manner so as to protect the samples, the material being sampled, the sampling instrument and the containers for samples from adventitious contamination.

G-1.3 The samples shall be placed in clean and dry glass containers.
G-1.4 The sample containers shall be sealed air-tight after filling and marked with full details of sampling, date of manufacture, name of manufacturer and other important particulars of the consignment.

G-1.5 Samples shall be stored in such a manner that the conditions of storage do not unduly affect the quality of the material.

G-2. SCALE OF SAMPLING

G-2.1 Lot — All the containers in a single consignment of the material of the same grade, drawn from a single batch of manufacture shall constitute a lot. If a consignment is declared to consist of different batches of manufacture, the containers belonging to the same grade and batch shall be grouped together. Each group shall constitute separate lots.

G-2.2 Gross Sample — For the purpose of drawing samples for test, one container from each lot shall be selected by the purchaser. This container shall constitute the gross sample.

G-2.2.1 The container selected for the gross sample shall not be damaged or leaky and shall have its seal intact.

G-3. PROCEDURE FOR DRAWING A SAMPLE FROM THE CONTAINER

G-3.1 Sampling Pump — For the purpose of drawing a sample of liquid glucose from the container, it is recommended that a pump of the type shown in Fig. 2 may be used. The pump is made of copper. The tube of the pump is 2 mm thick, with an internal diameter of 42 mm. The tube is provided with a downward bent spout at 76 mm from the upper end of the screw top. The spout is of 19 mm internal diameter. The piston is provided with lifting up valves. The piston rod is 8 mm in diameter and is made of copper. The rod is provided with a locking device at its top so that it may not have to be kept pressed down while the material rises up inside the tube.

G-3.2 Method of Sampling — Place the container selected for the purpose of sampling at a clean and dry place. Thoroughly clean the lid of the opening of the container and the area round about the opening with soap and water. Wipe the cleaned area dry. Remove the lid of the opening and take out with a ladle sufficient quantity of the material to remove the top scum, if any. Insert the pump (see G-3.1) with its piston locked in position, through the opening of the container and very slowly press the pump down to the extent of the upper one-third height of the container. Hold the pump in this position for five minutes. Again very slowly press the pump down through the middle one-third height of the container and hold the pump in that position for five minutes. Press the pump down again very slowly and when it touches the bottom of the container,
All dimensions in millimetres.

FIG. 2 SAMPLING PUMP
raise it a little so that it is just above the bottom of the container. Allow
the pump to remain in that position again for five minutes. (The pump
will have been filled in by this time.) Take out the pump and wipe its
outside surface so as to remove the material which may be adhering to it.
Unlock the piston and work it very slowly through one complete upward
movement, simultaneously, collecting the material flowing out of the
spout in a perfectly clean and dry sample container. Repeat the operation
of drawing samples in the above manner, until a quantity of about 2 kg of
the material is collected in the sample container.

G-4. TEST SAMPLES AND REFEREE SAMPLE

G-4.1 Preparation of Test Samples — To prepare test samples,
thoroughly mix the material drawn as specified under G-3.2 and divide it
into three equal parts, each part (test sample) being not less than 0.6 kg.
Transfer these test samples to thoroughly clean and dry sample containers,
and seal them air-tight. Label the sample containers with all the
particulars given under G-1.4. One of these samples shall be sent to the
purchaser and one to the vendor.

G-4.2 Referee Sample — The third sample, bearing the seals of the
purchaser and the vendor, shall constitute the referee sample to be used
in case of dispute between the purchaser and the vendor. It shall be kept
at a place agreed between the purchaser and the vendor.

G-5. NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

G-5.1 The test sample as prepared under G-3.2 shall be tested for all
characteristics (see 4) of this specification.

G-5.2 The lot shall be declared as conforming to this specification if the
test results satisfy the requirements of each of the characteristics.
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