

इंटरनेट

मानक

Disclosure to Promote the Right To Information

Whereas the Parliament of India has set out to provide a practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, and whereas the attached publication of the Bureau of Indian Standards is of particular interest to the public, particularly disadvantaged communities and those engaged in the pursuit of education and knowledge, the attached public safety standard is made available to promote the timely dissemination of this information in an accurate manner to the public.

“जानने का अधिकार, जीने का अधिकार”

Mazdoor Kisan Shakti Sangathan

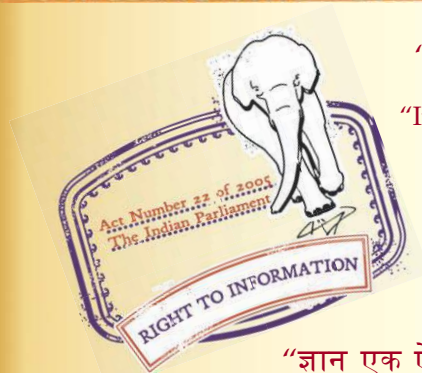
“The Right to Information, The Right to Live”

“पुराने को छोड़ नये के तरफ”

Jawaharlal Nehru

“Step Out From the Old to the New”

IS 840 (1986): Cashewnut Shell Liquid (CNSL) [CHD 20: Paints, Varnishes and Related Products]



“ज्ञान से एक नये भारत का निर्माण”

Satyanarayan Gangaram Pitroda

“Invent a New India Using Knowledge”



“ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है”

Bhartrhari—Nitiśatakam

“Knowledge is such a treasure which cannot be stolen”

BLANK PAGE



Indian Standard

SPECIFICATION FOR
CASHEWNUT SHELL LIQUID (CNSL)
(*Second Revision*)

First Reprint JULY 1994

UDC 634.573 : 66.061.3

© Copyright 1987

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002

Indian Standard

SPECIFICATION FOR CASHEWNUT SHELL LIQUID (CNSL) (Second Revision)

Raw Materials for Paint Industry Sectional Committee, CDC 50

Chairman

SHRI R. K. MARPHATIA

Representing

Goodlass Nerolac Paints Ltd, Bombay

Members

SHRI S. S. ANAKAIKAR (Alternate to

Shri R. K. Marphatia)

SHRI K. M. BANERJEE

National Test House, Calcutta

SHRI S. BHATTACHARYYA

IEL Limited, Calcutta

SHRI G. N. TEWARI (Alternate)

CHEMIST & METALLURGIST-I

Research, Design and Standards Organization
(Ministry of Railways), Lucknow

ASSISTANT RESEARCH OFFICER

(CM-II) (Alternate)

SHRI M. C. CHOKSI

Resins & Plastics Pvt Ltd, Bombay

SHRI O. P. DHAMLA

Export Inspection Council of India, Calcutta

SHRI S. N. DUTTA (Alternate)

DR A. B. KARNIK

Colour-Chem Ltd, Bombay

SHRI M. E. MARATHE (Alternate)

SHRI R. D. KAWATRA

Directorate General of Technical Development,
New Delhi

SHRI KULTAR SINGH (Alternate)

SHRI P. R. MALHAN

Development Commissioner (SSI), New Delhi

SHRI R. MUKOPADHYAY (Alternate)

SHRI K. C. MEHTA

Indian Oil Corporation Ltd, Faridabad

SHRI B. RAMA MURTI

Travancore Titanium Products Ltd, Trivandrum

DR V. S. VAJAYAN NAYAR (Alternate)

DR R. J. RATHI

Sudarshan Chemical Industries Ltd, Pune

SHRI K. L. RATHI (Alternate)

SHRI R. R. SEQUEIRA

Garware Paints Ltd, Bombay

SHRI C. R. THUSE (Alternate)

DR G. K. SINGHANIA

Ministry of Defence (R & D)

SHRI L. K. LOOMBA (Alternate)

SHRI S. K. SRIVASTAVA

Oil Technologists Association of India, Kanpur

SHRI SURENDRA GANG (Alternate)

(Continued on page 2)

© Copyright 1987

BUREAU OF INDIAN STANDARDS

This publication is protected under the *Indian Copyright Act* (XIV' of 1957) and reproduction in whole or in part by any means except with written permission of the publisher shall be deemed to be an infringement of copyright under the said Act.

(Continued from page 1)

| <i>Members</i> | <i>Representing</i> |
|---|--|
| SHRI M. S. SULTANIA | Ministry of Defence (DGI) |
| SHRI R. S. SENGAR (<i>Alternate</i>) | |
| DR R. B. TIRODKAR | Asian Paints (India) Ltd, Bo |
| SHRI V. M. NATU (<i>Alternate</i>) | |
| SHRI T. K. VISWANATHAN | Addisons Paints & Chemical Ltd, Madras |
| SHRI K. R. SANTHANAN (<i>Alternate</i>) | |
| SHRI P. M. VYAS | Indian Paint Association, Calcutta |
| SHRI D. K. ROY (<i>Alternate</i>) | |
| SHRI SATISH CHANDER, Director (Chem) | Director General, BIS (<i>Ex-officio Member</i>) |

Secretary

SHRI M. M. MALHOTRA
Deputy Director (Chem), BIS

Resins Subcommittee, CDC 50 : 4

Convener

SHRI M. C. CHOKSI Resins & Plastics Pvt Ltd, Bombay

Members

| | |
|---|--|
| ASSISTANT RESEARCH OFFICER (CM-II) | Ministry of Railways |
| SHRI S. K. ASTHANA | Ministry of Defence (DGI) |
| SHRI S. S. KATIYAR (<i>Alternate</i>) | |
| SHRI V. S. BOAHRE | Hindustan Ciba Geigy, Bombay |
| SHRI V. H. DESAI | ILAC India Ltd, Bombay |
| SHRI S. MITRA (<i>Alternate</i>) | |
| SHRI S. C. JAIN | Goodlass Nerolac Paints Ltd, Bombay |
| SHRI V. M. NATU | Asian Paints (India) Ltd, Bombay |
| DR A. V. RAO (<i>Alternate</i>) | |
| SHRI S. V. R. SEKHAR | Reichold Chemicals India Ltd, Madras |
| SHRI JANKIRAMAN (<i>Alternate</i>) | |
| SHRI G. N. TEWARI | IEL Limited, Calcutta |
| DR S. D. YADAV | Ghowgule & Co (Hind) Pvt Ltd, Bombay |
| SHRI V. M. NACHANE (<i>Alternate</i>) | |

Indian Standard
SPECIFICATION FOR
CASHEWNUT SHELL LIQUID (CNSL)
(Second Revision)

0. FOREWORD

0.1 This Indian Standard (Second Revision) was adopted by the Indian Standards Institution on 20 November 1986, after the draft finalized by the Raw Materials for Paints Industry Sectional Committee had been approved by the Chemical Division Council.

0.2 This standard was first issued in 1956. It was then revised in 1964 when catalytic method was added as an alternate to Wij's method for determination of iodine value. Since the two methods give widely different values, two different iodine values were prescribed according to the methods followed. The limit for iodine value by following Wij's method was raised from 220 to 250, loss in weight on heating and viscosity after acid washing were added, and the requirement for acid value was deleted. Recently, comments were received that 'catalytic method' gives higher iodine value and thus does not agree with the iodine value obtained by hydrogenation method. In view of this, the Committee decided to revise the standard after replacing the 'catalytic method'.

0.3 In this second revision 'catalytic method' has been replaced by Rosenmund-Kuhnhehn (R. K.) method. The iodine value obtained by R. K. Method agrees well with the value obtained by hydrogenation method. The limit of iodine value by following this method has also been modified.

0.4 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.

*Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard prescribes the requirements and the methods of sampling and test for cashewnut shell liquid. The material is used as a phenolic component in many commercial resins, resinous compositions, moulding compositions, protective coatings and insulating varnishes.

2. REQUIREMENTS

2.1 Description

2.1.1 Source — The material shall be produced from the shells of cashewnuts (*Anacardium occidentale*).

2.1.2 The material shall be free from separated water and extraneous matter.

2.1.3 Colour — The material shall be not deeper than dark brown when viewed by transmitted light.

2.2 The material shall also comply with the requirements given in Table I, when tested according to the methods prescribed in Appendix A. Reference to relevant clauses of Appendix A is given in col 4 of the table.

TABLE I REQUIREMENTS FOR CASHEWNUIT SHELL LIQUID (CNSL)

| Sl. No. | CHARACTERISTIC | REQUIREMENT | METHOD OF TEST (REF TO CL NO. IN APPENDIX A) |
|---------|---|----------------|--|
| (1) | (2) | (3) | (4) |
| i) | Specific gravity, 30/30°C | 0.950 to 0.970 | A-2 |
| ii) | Viscosity at 30°C, in centipoises, <i>Max</i> | 550 | A-3 |
| iii) | Moisture, percent by weight, <i>Max</i> | 1.0 | A-4 |
| iv) | Matter insoluble in toluene, percent by weight, <i>Max</i> | 1.0 | A-5 |
| v) | Loss in weight on heating, percent by weight, <i>Max</i> | 2.0 | A-6 |
| vi) | Ash, percent by weight, <i>Max</i> | 1.0 | A-7 |
| vii) | Iodine value (<i>see</i> 0.2), <i>Min</i> | | A-8 |
| | a) Wij's method | 250 | A-8.1 |
| | b) RK method | 290 | A-8.2 |
| viii) | Polymerization | | |
| | a) Time in minutes, <i>Max</i> | 4 | A-9 |
| | b) Viscosity at 30°C, in centipoises, <i>Min</i> | 30 | A-10 |
| | c) Viscosity after acid washing at 30°C, in centipoises, <i>Min</i> | 200 | A-11 |

3. PACKING AND MARKING

3.1 The material shall be packed in containers or transported in bulk as agreed to between the purchaser and the supplier.

3.2 Each container shall be marked with the name of the manufacturer; weight of the material in the container; recognized trade-mark, if any; and the month and year of manufacture.

3.2.1 The containers may also be marked with the Standard Mark.

3.2.2 The use of the Standard Mark is governed by the provisions of 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.

4. SAMPLING

4.1 Preparation of Test Samples — The method of drawing representative test samples of the material and the criteria for conformity shall be as prescribed in Appendix B.

APPENDIX A

(Clause 2.2 and Table 1)

ANALYSIS OF CASHEWNUT SHELL LIQUID (CNSL)

A-1. QUALITY OF REAGENTS

A-1.1 Unless specified otherwise, pure chemicals and distilled water (see IS : 1070-1977*) shall be used in all tests.

NOTE — 'Pure chemicals' shall mean chemicals that do not contain impurities which affect the result of analysis.

A-2. DETERMINATION OF SPECIFIC GRAVITY

A-2.0 Principle — The specific gravity of the material is determined with a specific gravity bottle.

A-2.1 Preparation of the Sample — Filter the material through filter paper, glass wool or any other suitable filtering medium to remove traces of suspended impurities. Suction may be used if necessary.

*Specification for water for general laboratory use (second revision).

A-2.2 Apparatus

A-2.2.1 Thermometer — Any convenient thermometer of a suitable range with 0.1 or 0.2°C subdivisions.

A-2.2.2 Water-Bath

A-2.2.3 Specific Gravity Bottle — A specific gravity bottle of about 50-ml capacity with wellfitted ground glass joints and of the shape as shown in Fig. 1 is recommended. To calibrate, clean and dry the bottle thoroughly, weigh and then fill with boiled and cooled water at 30°C. Fill to overflowing by holding the bottle on its side in such a manner as to prevent the entrapment of air bubbles. Insert the stopper and immerse in a water-bath at $30 \pm 0.2^\circ\text{C}$. Keep the entire bulb completely covered with water and hold at that temperature for 30 minutes. Carefully remove any water which has exuded from the capillary opening. Remove from the bath, wipe completely dry, cool to room temperature and weigh. Calculate the weight of water. This is a constant for the bottle but should be checked periodically.

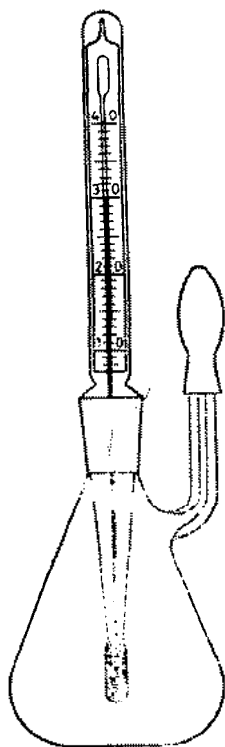


FIG. 1 50 ml SPECIFIC GRAVITY BOTTLE

A-2.3 Procedure — Fill the specific gravity bottle with the material to over-flowing, holding the bottle on its side in such a manner as to prevent the entrapment of air bubbles. Insert the stopper, immerse in the water-bath maintained at $30.0 \pm 0.2^\circ\text{C}$ and hold for 30 minutes. Carefully wipe off any oil which has come through the capillary opening. Remove the bottle from the bath and wipe it completely dry. Cool to room temperature and weigh.

A-2.4 Calculation

$$\text{Specific gravity at } 30/30^\circ\text{C} = \frac{A - B}{C - B}$$

where

A = weight in g of the specific gravity bottle with material at 30°C ,

B = weight in g of the empty specific gravity bottle, and

C = weight in g of the specific gravity bottle with water at 30°C .

A-3. DETERMINATION OF VISCOSITY

A-3.0 Principle — The viscosity of the material is determined with a U-tube viscometer.

A-3.1 Apparatus

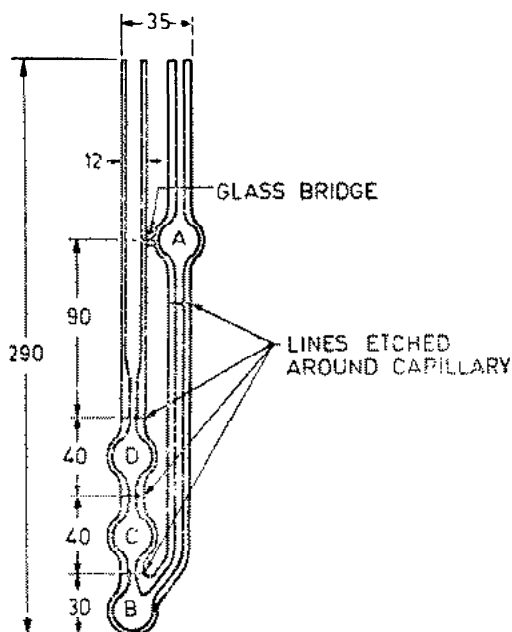
A-3.1.1 U-Tube Viscometer — The U-tube viscometer shown in Fig. 2 shall be of homogeneous transparent glass and shall be free from mechanical imperfections. All glass tubing employed in the construction of the viscometer shall be of the same composition and the finished instrument shall be thoroughly annealed.

A-3.1.2 Thermometer — Any convenient thermometer of a suitable range with subdivisions of 0.2°C .

A-3.1.3 Bath — A water-bath, suitable for immersion of the viscometer to within 5 cm of the top, with provision for visibility of the instrument and the thermometer, shall be provided. The viscometer may be fixed as an integral part of the bath. The thermometer shall be mounted with the bulb near the centre of the viscometer. The bath shall be regulated so that the variation in the thermometer reading does not exceed 0.2°C . Use of a thermoregulator is recommended.

A-3.1.4 Time-Recording Device — a suitable stop watch.

A-3.1.5 Frame — Suitable frames shall be provided so that the viscometers may be suspended securely in the bath in a vertical position.



All dimensions in millimetres.

FIG. 2 U-TUBE VISCOMETER

A-3.2 Procedure

A-3.2.1 Clean the viscometer by rinsing with suitable solvents, such as benzene (see IS : 534-1974*) followed by ethyl ether (see IS : 336-1973†) or petroleum hydrocarbon solvents (see IS : 1743-1978‡). Remove each solvent by passing a current of dry air through it and take care that no moisture remains inside the instrument.

A-3.2.2 Fill the viscometer by holding it in an inverted position with the capillary side submerged in the material under test. Apply suction to the arm of the viscometer either by sucking through a piece of rubber tubing or a water aspirator. Fill the main reservoir A and bring the liquid into the capillary to the etched line just below A. Wipe the excess liquid off the end of the capillary arm and incline the instrument slightly to cause the oil to flow by gravity from the upper capillary

*Specification for benzene (second revision).

†Specification for ether (second revision).

‡Specification for petroleum hydrocarbon solvents (second revision).

into *A*. Discharge this small amount of liquid into the main capillary leading to bulb *B*. Slip a short piece of rubber tubing with a pinch clamp over the open end of the upper capillary to close one end. Turn the viscometer to a vertical position and place in the constant temperature bath maintained at $30 \pm 0.2^\circ\text{C}$. During this time, prevent the entrance of dust and moisture. Remove the pinch clamp when the equilibrium is reached and allow the liquid to flow by gravity. Start the stop watch just when the liquid passes the etched line between *B* and *C*. Note the time required for the meniscus to reach the etched line above *C* [efflux time (i)] and then to the etched line above *D* [efflux time (ii)].

A-3.2.3 The bulb *B*, which the liquid enters at the base of capillary is for the purpose of allowing some liquid to discharge from the upper reservoir *A* and thus the diameter of the meniscus in this bulb is large throughout the test. This reduces both the effect of loading errors and surface tension corrections.

A-3.3 Calculation

A-3.3.1 Calculate the kinematic viscosity in centistokes from each efflux time by the formula given below. The viscosities so calculated separately for each bulb should agree:

$$V = C t$$

where

V = kinematic viscosity in centistokes,

C = the determined calibration constant for the instrument (see A-3.4), and

t = time of flow in seconds.

A-3.3.2 Calculate the dynamic viscosity in centipoises from the following:

$$\text{Dynamic viscosity in cp} = \text{Kinematic viscosity in cs} \times \text{specific gravity (see A-2.5)}$$

A-3.4 Determination of Calibration Constant

A-3.4.1 Unless the calibration constant is already known, calibrate the viscometer using, as primary standard, oil samples the viscosities of which have been determined by the National Physical Laboratory, New Delhi, or any other Institution recognized by the Government of India.

A-3.4.2 Determine, in the viscometer being calibrated, the flow time of the appropriate standard, which shall not be less than 200 seconds.

A-3.4.3 Then calculate the calibration constant *C*, by substituting in the equation under A-3.3.1 the flow time and the kinematic viscosity of the oil.

A-3.4.4 The calibration constant shall be determined at a temperature of $30 \pm 0.2^\circ\text{C}$.

A-4. DETERMINATION OF MOISTURE

A-4.0 Principle — The material is heated under reflux with an organic liquid which is immiscible with water. The carrier liquid distills into a graduated receiver carrying with it water which then separates to form lower layer, the excess carrier liquid overflowing from the trap and returning to the still.

A-4.1 Apparatus — The apparatus commonly known as 'Dean Stark Apparatus' consists of a glass flask heated by suitable means and provided with a reflux condenser discharging into a trap and connected to the flask. The connections between the trap, the condenser and the flask should be interchangeable ground glass joints. Alternatively, ordinary flask may be used with an unground receiver end. The trap serves to collect and measure the condensed water, and to return the solvent to the flask. The assembly of the apparatus is shown in Fig. 3 and the various components are described under **A-4.1.1** to **A-4.1.5**.

A-4.1.1 Flask — A 500- to 1 000-ml flask of the shape shown in Fig. 3, made of hard resistance glass, well annealed and as free as possible from striae and similar defects.

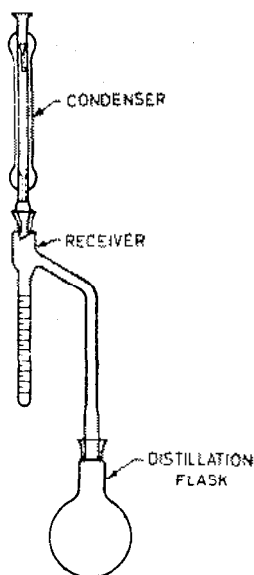
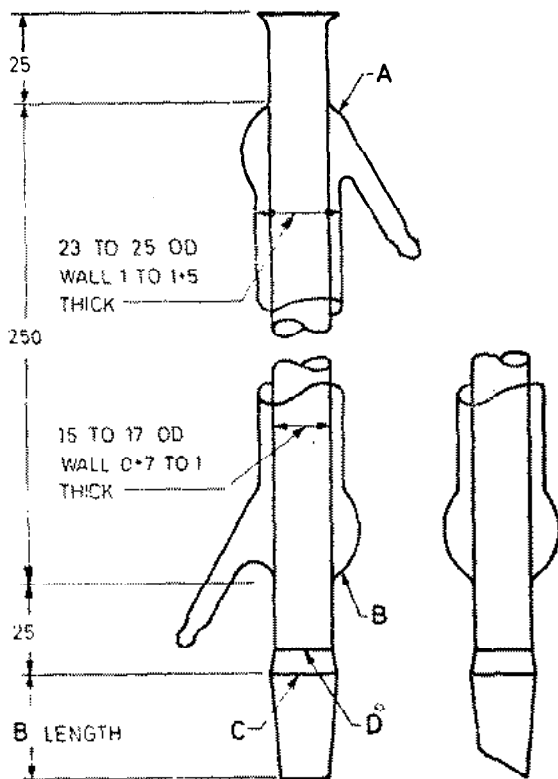


FIG. 3 TYPICAL ASSEMBLY OF MOISTURE DISTILLATION APPARATUS

A-4.1.2 Condenser — shall be a glass water-cooled reflux type, of the design and dimensions shown in Fig. 3A. The only mandatory dimensions for the condenser are the external diameters of the inner tube and of the jacket, which shall be 16-17 mm and 23-25 mm respectively. The joints *A* and *B* shall be neatly finished as shown in Fig. 3A, particularly the bore at *B* shall have the minimum disturbance. The shoulder above the cone of joint *D* shall be elongated as shown in Fig. 3A to avoid a sharp re-entrant shape which may restrict the free flow of liquid down the inner wall. The cone shall be extended beyond the length appropriate to the joint *D*, and the lower end ground at an angle of approximately 60° to the axis. The drainage tip shall be at the front of the condenser when the lower water connection is to the left, and the finish shall be either smooth or fire-polished. When inserted into the



All dimensions in millimetres.

FIG. 3A CONDENSER

trap, the tip of the condenser shall be 6 to 7 mm above the surface of the liquid in the trap after distillation conditions have been established. The nominal dimensions of the joint *D* are given below:

| <i>Nominal Dia of Large End of Ground Zone</i> | <i>Nominal Dia of Small End of Ground Zone</i> | <i>Nominal Length of Ground Zone Measured Axially</i> |
|--|--|---|
| mm | mm | mm |
| 18.8 | 16.2 | 26 |

A-4.1.3 Receiver — Otherwise called the trap, made of hard resistance glass, well annealed and as free as possible from striæ and similar defects, provided with ground glass joints, with the shape, dimensions and tolerances as shown in Fig. 3B, consisting essentially of the upper chamber, together with the tube and ground joint leading to the flask, and the graduated tube.

The receiver shall be of 2-ml capacity. The mandatory dimensions and tolerances for the receiver shall be as given in Table 2.

TABLE 2 MANDATORY DIMENSIONS AND TOLERANCES FOR RECEIVER

| SL No. | CHARACTERISTIC | RECEIVER |
|-----------|--|----------|
| (1) | (2) | (3) |
| i) | Volume, equivalent to smallest subdivision, ml | 0.05 |
| ii) | Scale length, mm | 95 ± 10 |
| iii) | Length of cylindrical tube above upper graduation mark, mm | 10-15 |
| iv) | Tolerance on capacity, plus or minus, ml | 0.02 |

The shoulder of the upper chamber of the receiver immediately below the conical joint shall be finished square, as shown in Fig. 3B. The graduated portion of the receiver shall be cylindrical throughout its length. The bottom of the graduated tube of the receiver shall be sealed, the end of the tube being approximately hemispherical in shape. The graduated scales on the receivers shall be numbered and subdivided as shown in Fig. 3B. The graduation marks shall be fine, clearly etched permanent lines of uniform thickness lying in planes at right angles to the axis of the tube. The graduation marks shall be confined to the cylindrical portion of the tube and there shall be no evident irregularity in their spacing. In these receivers, the numbered graduation marks shall be carried completely round the tube, the shortest graduation marks shall be carried half-way round the tube, and the graduation

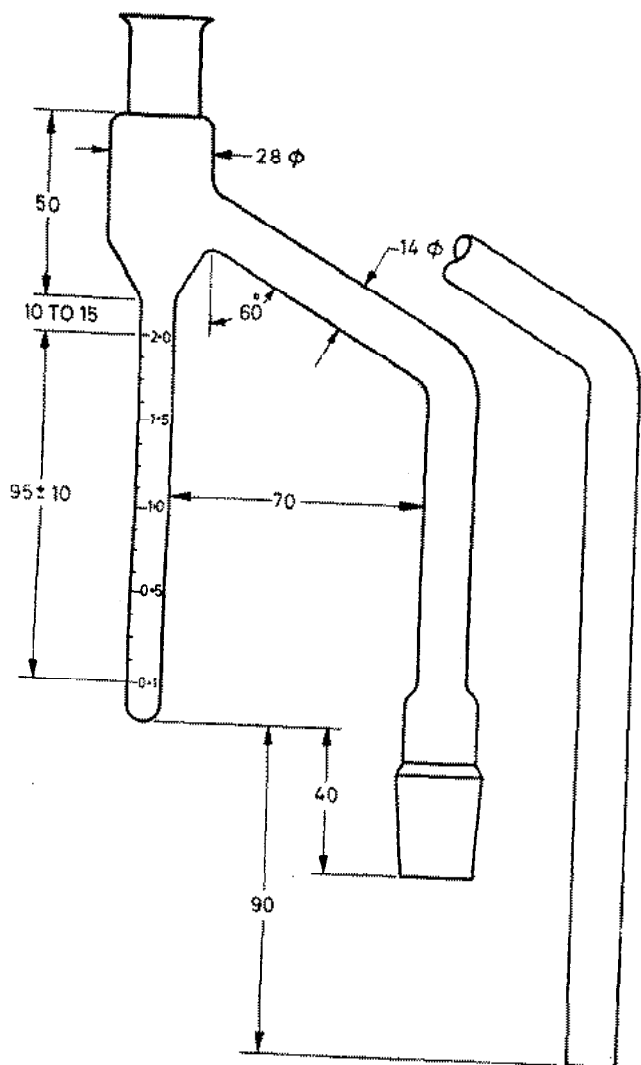


FIG. 3B 2-ml RECEIVER SHOWING ALTERNATIVE CONNECTIONS TO THE DISTILLATION VESSEL

marks of intermediate length shall be carried approximately two-thirds of the way round the tube and shall project equally at each end beyond the shortest graduation marks.

The capacity corresponding to any graduation mark is defined as the volume of water at 27°C, expressed in millilitres, required to fill the graduated portion to that mark at 27°C, the axis of the graduated portion being vertical and the lowest point of the water meniscus being set on the graduation mark.

The error at any point on the receiver scale, and also the difference between the errors at any two points on the scale, shall not exceed the figures given for the receivers in Table 2.

Each receiver shall have permanently and legibly marked on it:

- a) The abbreviation 'ml';
- b) The inscription '27°C' to indicate that the receiver is graduated for contents at 27°C; and
- c) An identification number on the key.

A-4.1.4 Heat Source — The source of heat may be either an oil bath or an electric heater provided with a sliding rheostat or other means of heat control. The temperature of the oil in the bath shall not be very much higher than the boiling point of xylene or toluene, whichever solvent is used.

A-4.1.5 Copper Wire — long enough to extend through the condenser, with one end twisted into a spiral. The diameter of the spiral shall be such that it fits snugly within the graduated portion of the receiver and yet can be moved up and down.

A-4.2 Reagents

A-4.2.1 Potassium Dichromate-Sulphuric Acid Cleaning Solution

A-4.2.2 Xylene or Toluene — Saturate the xylene or toluene by shaking with a small quantity of water, and distil. Use the distillate for the determination of moisture.

A-4.3 Procedure

A-4.3.1 Clean the entire apparatus with potassium dichromate-sulphuric acid cleaning solution to minimize the adherence of water droplets to the sides of the condenser and the receiver. Rinse thoroughly with water and dry completely before using.

A-4.3.2 Place about 100 g of the material, accurately weighed, in the distillation flask and add an equal volume of the solvent xylene or toluene, as desired. Assemble the apparatus and fill the receiver with the solvent by pouring it through the condenser until it begins to over-flow

into the distillation flask. Insert a loose cotton plug in the top of the condenser to prevent condensation of atmospheric moisture within the tube. In order that the refluxing may be under control, wrap the flask and tube leading to the receiver with asbestos cloth. Heat the flask to the distillation rate at about 100 drops per minute. When the greater part of the water has distilled over, increase the distillation rate to about 200 drops per minute and continue until no more water is collected. Purge the reflux condenser occasionally during the distillation with five millilitre-portions of xylene or toluene to wash down any moisture adhering to the walls of the condenser. The water in the receiver may be made to separate from the xylene or toluene by moving the spiral copper wire up and down in the condenser and receiver occasionally, thus causing the water to settle at the bottom of the receiver. Reflux until the water level in the receiver remains unchanged for 30 minutes and then shut off the source of heat. Flush the condenser with xylene or toluene as required, making use of the spiral copper wire to discharge any moisture droplets. Immerse the receiver in water at about 27°C for at least 15 minutes or until the xylene or toluene layer is clear, and then read the volume of water.

A-4.4 Calculation

$$\text{Moisture, percent by weight} = \frac{100 VD}{W}$$

where

V = volume in ml of water,

D = specific gravity of water at the temperature at which the volume of water is read, and

W = weight in g of the material taken for the test.

A-5. DETERMINATION OF MATTER INSOLUBLE IN TOLUENE

A-5.1 Reagent

A-5.1.1 Toluene — conforming to IS : 537-1967*.

A-5.2 Procedure — Weigh accurately about 50 g of the well-mixed material into a conical flask and dissolve by warming on a water-bath, in four times its volume of toluene, the flask being loosely covered. Then filter the solution through a weighed sintered glass crucible (G No. 1), previously dried at $100 \pm 2^\circ\text{C}$ (see Note). Transfer any insoluble residue to the crucible by means of additional toluene and wash the residue with toluene until a few drops of the filtrate yield no residue on evaporation. Dry the crucible at $100 \pm 2^\circ\text{C}$ to constant weight.

*Specification for toluene, pure, nitration grade (first revision).

NOTE — In place of sintered glass crucible, counterpoised double filter papers (for example, Whatman No. 5) about 150 mm in diameter may be used. Reduce the two folded filter papers to equal weight by removing the apex of the heavier filter paper. Heat the two to a temperature of $100 \pm 2^\circ\text{C}$. For filtering, use the uncut paper inside the originally heavier paper so that the separated material is retained by the inner paper, yet both of them are equally subjected to any action exerted by the oil and toluene.

A-5.3 Calculation

$$\begin{array}{l} \text{Matter insoluble in toluene,} \\ \text{percent by weight} \end{array} = \frac{0.01 w}{W}$$

where

w = weight in g of residue, and

W = weight in g of the material taken for the test.

A-6. DETERMINATION OF LOSS IN WEIGHT ON HEATING

A-6.1 Procedure — Weigh accurately 100 g of the material in a 400-ml beaker. Heat the beaker together with the material for 30 minutes on an electric hot-plate maintained at $205 \pm 5^\circ\text{C}$ and stir the material after every two minutes. At the end of this period, remove the beaker, allow it to cool to room temperature and weigh again.

A-6.2 Calculation

$$\begin{array}{l} \text{Loss in weight on heating,} \\ \text{percent by weight} \end{array} = \frac{100 w}{W}$$

where

w = loss in weight in g of the material on heating, and

W = weight in g of the material taken for the test.

A-7. DETERMINATION OF ASH

A-7.1 Apparatus

A-7.1.1 Dish — made of platinum, porcelain, or silica, or any wide-form crucible of suitable capacity.

A-7.2 Reagents

A-7.2.1 Ethyl Alcohol — conforming to IS : 321-1964*.

A-7.2.2 Benzene — conforming to IS : 1840-1961†.

A-7.3 Procedure — Heat the dish to redness. Allow it to cool in a desiccator and weigh it to the nearest 0.1 mg. Weigh accurately, to the nearest 0.1 mg, about 2 g of the material from a weighing bottle into the

*Specification for absolute alcohol (revised).

†Specification for benzene, reagent grade.

dish. Heat the dish gently by means of a burner until the material can be ignited at the surface (*see Note*). Allow the combustible matter to burn off slowly and heat the residue with a strong flame or in a muffle furnace until the ash is free from carbonaceous matter. Cool the dish and its contents in a desiccator and weigh. Repeat heating and cooling till constant weight is obtained.

NOTE — In the case of materials containing sufficient moisture to cause foaming and loss, add one to two millilitres of ethyl alcohol before heating. If excessive foaming still occurs notwithstanding this treatment, add 10 ml of a mixture of equal volumes of benzene and ethyl alcohol and stir thoroughly with the material. Insert several strips of ashless filter paper into the mixture and then ignite. When most of the moisture is removed, the paper itself begins to burn. After this stage, the procedure given in A-7.3 shall be followed.

A-7.4 Calculation

$$\text{Ash, percent by weight} = \frac{100 w}{W}$$

where

w = weight in g of the ash, and

W = weight in g of the material taken for the test.

A-8. DETERMINATION OF IODINE VALUE

A-8.1 Principle — The material is treated in carbon tetrachloride medium, with a known excess of iodine monochloride solution in glacial acetic acid (*Wij's solution*). The excess of iodine monochloride is treated with potassium iodide and the liberated iodine estimated by titration with sodium thiosulphate solution. Any one of the two methods of test, namely, *Wij's method* and *Rosenmund Kuhnhehn method* shall be followed for the determination of iodine value as agreed to between the purchaser and the supplier. The *Rosenmund Kuhnhehn method* is much quicker than *Wij's method* and at the same time gives repeatable and reproducible results.

A-8.1 *Wij's Method*

A-8.1.1 *Reagents*

- a) *Potassium dichromate* — conforming to IS : 250-1964*.
- b) *Concentrated hydrochloric acid* — conforming to IS : 265-1976†.
- c) *Potassium iodide solution* — Prepare a fresh solution by dissolving 10 g of potassium iodide free from potassium iodate, in 50 ml of water.

*Specification for potassium bichromate, technical and analytical reagent (*revised*).

†Specification for hydrochloric acid (*second revision*).

- d) *Starch solution* — Triturate 5 g of starch and 0.01 g of mercuric iodide with 30 ml of cold water and slowly pour it with stirring into one litre of boiling water. Boil for three minutes. Allow to cool and decant off the supernatant clear liquid.
- e) *Standard sodium thiosulphate solution* — approximately 0.1 N. Dissolve approximately 24.8 g of sodium thiosulphate crystals ($\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$) in water which has been well boiled to free it from carbon dioxide and make up to 1 000 ml. Store the solution in a cool place in a dark coloured stock bottle with a guard tube filled with soda lime. After storing the solution for about two weeks, filter if necessary and standardize it as prescribed below:

Weigh accurately about 5.0 g of finely ground potassium dichromate which has been previously dried to a constant weight at $105 \pm 2^\circ\text{C}$ into a clean one-litre volumetric flask. Dissolve in water, make up to the mark; shake thoroughly and keep the solution in a cool dark place. For standardization of sodium thiosulphate, pipette 25 ml of this solution into a clean glass stoppered 250-ml conical flask or bottle. Add 5 ml of concentrated hydrochloric acid and 15 ml of a 10 percent potassium iodide solution. Allow to stand in the dark for 5 minutes and titrate the mixture with the solution of sodium thiosulphate, using starch solution as an internal indicator towards the end. The end point is taken when the blue colour changes to green. Calculate the normality (N) of the sodium thiosulphate solution as follows:

$$\frac{25 W}{49.03 V}$$

where

W = weight in g of the potassium dichromate, and

V = volume in ml of sodium thiosulphate solution required for the titration.

- f) *Iodine crystals* — re-sublimed.
- g) *Acetic acid* — glacial, 99 percent (see IS : 695-1986*) and free from reducing impurities. Test for reducing impurities is as follows:

Dilute 2 ml of the acetic acid with 10 ml of water and add 0.1 N potassium permanganate solution and maintain at $27 \pm 2^\circ\text{C}$. The test shall be taken as having been satisfied if the pink colour is not discharged at the end of two hours.

- h) *Chlorine gas* — dry.

*Specification for acetic acid (third revision).

- j) *Iodine trichloride* (ICl_3)
- k) *Iodine monochloride* (ICl) — 98 percent, chemically pure.
- m) *Wij's iodine monochloride solution* — Prepare this solution by one of the following two methods, and store in a glass stoppered bottle in a cool place, protected from light:
 - i) Dissolve 13 g of iodine in one litre of acetic acid, using gentle heat, if necessary, and determine the strength by titration with standard sodium thiosulphate solution. Set aside 50 to 100 ml of the solution and introduce chlorine gas into the remainder until the characteristic colour change occurs and the halogen content is nearly doubled as ascertained again by titration. If the halogen content has been more than doubled, reduce it by adding the requisite quantity of the iodine-acetic acid solution. A slight excess of iodine does no harm, but avoid an excess of chlorine.

Example:

If the titration of 20 ml of original iodine-acetic acid solution requires 22 ml of standard sodium thiosulphate 20 ml of the finished Wij's solution shall require between 43 to 44 ml (and not more than 44 ml) of the same sodium thiosulphate solution.

- ii) Dissolve eight grams of iodine trichloride in approximately 450 ml of acetic acid. Dissolve separately nine grams of iodine in 450 ml of acetic acid, using heat, if necessary. Add gradually the iodine solution to the iodine trichloride until the colour has changed to reddish-brown. Add 50 ml more of iodine solution and dilute the mixture with acetic acid till 10 ml of the mixture is equivalent to 20 ml of standard thiosulphate solution when the halogen content is estimated by titration in the presence of an excess of potassium iodide and water. Heat the solution to 100°C for 20 minutes, and cool. Prevent access of water vapour in preparing the solution.
- n) *Carbon tetrachloride or chloroform* — inert to Wij's solution.

A-8.1.2 Procedure — Take 50 g of the cashewnut shell liquid in a 250-ml beaker and heat slowly to $205 \pm 5^\circ\text{C}$ on an electric hot plate stirring thoroughly to prevent violent foaming. As soon as this temperature is reached cover the beaker and cool it undisturbed to room temperature. Filter the material through a filter paper to remove any impurities. Make sure that the glass apparatus used is absolutely clean and dry. Weigh accurately by difference about 0.10 to 0.12 g of the filtered material in a clean dry 500-ml iodine flask or well ground glass-stoppered bottle to which 25 ml of carbon tetrachloride has been added and agitate to dissolve the contents. The weight of the sample shall be

such that there is an excess of Wij's solution 50 to 60 percent of the amount added. Add 25 ml of the Wij's solution and replace the glass stopper after wetting with potassium iodide solution; swirl for intimate mixing, and allow to stand in the dark for one hour. Carry out a blank test simultaneously under similar experimental conditions. After standing, add 15 ml of potassium iodide solution and 100 ml of water, rinsing in the stopper also, and titrate the liberated iodine with standard sodium thiosulphate solution, swirling the contents of the bottle continuously to avoid any local excess until the colour of the solution is straw yellow. Add one millilitre of the starch solution and continue the titration until the blue colour formed disappears after thorough shaking with the stopper on.

A-8.1.3 Calculation

$$\text{Iodine value} = \frac{12.69 (B - S) N}{W}$$

where

B = volume in ml of standard sodium thiosulphate solution required for the blank,

S = volume in ml of standard sodium thiosulphate solution required for the sample,

N = normality of the standard sodium thiosulphate solution, and

W = weight in g of the material taken for the test.

A-8.2 Rosenmund — Kuhnemann Method

A-8.2.1 Reagents

- Carbon tetrachloride* — see IS : 718-1977*.
- Mercuric acetate solution* — 2.5 percent solution in glacial acetic acid.
- Potassium iodide solution* — Prepare a fresh solution by dissolving 15 g of potassium iodide in 100 ml water.
- Rosenmund-Kuhnemann reagent* — Place 40 ml of glacial acetic acid (CH_3COOH) in each of the three 250-ml Erlenmeyer flasks. To the first, add slowly 28.4 ± 0.2 g of pyridine, with cooling in an ice bath. To the second flask, add slowly 35.5 ± 0.2 g of concentrated sulphuric acid (H_2SO_4 , sp gr 1.84) with cooling as above. When cool, add the contents of the second flask to the contents of the first flask, with further cooling. To the third flask, add the contents of one ampule (containing 28.4 g) of bromine. Add the bromine liquid to the mixture of the first

*Specification for carbon tetrachloride (second revision).

two solutions. Transfer to a 1-litre volumetric flask with the aid of glacial acetic acid, and make up to 1 litre with glacial acetic acid. Mix thoroughly and transfer to a 4-litre, amber, glass-stoppered bottle. Add an additional 2.5 litres of glacial acetic acid, making a total of 3.5 litres of reagent. In this way, the weighing or measuring of bromine is eliminated. The reagent is approximately 0.1 N with respect to bromine. Fresh reagent should be prepared if the bromine concentration drops below 0.99 N. The normality of the reagent can be checked by running a reagent blank titration as described under A-8.2.2 but eliminating the one hour standing time.

NOTE — The stock bottle containing the Rosenmund-Kuhnnehn reagent should be kept stoppered when it is not in use to minimize the loss of bromine,

e) *Standard sodium thiosulphate solution* — Same as in A-8.1.1 (e).

f) *Starch solution* — Same as in A-8.1.1(d).

A-8.2.2 Procedure — Weigh accurately by difference 8.08 to 0.12 g of cashewnut shell liquid (CNSL) in a 250-ml iodine flask. Add 20 ml of the carbon tetrachloride and swirl to dissolve. Make sure that the specimen is completely dissolved, and then place the iodine flask in a dark place. Add 10.0 ml of mercuric acetate solution, swirl the flask two or three times, then add 50.0 ml of the Rosenmund Kuhnnehn reagent, and note the time. Replace the glass stopper in the flask after wetting with potassium iodide solution and add a small amount of potassium iodide solution alongside the stoppered joint of the flask to seal it, swirl until the contents are well mixed, and then place the flask in a dark place.

Exactly one hour after the addition of the Rosenmund-Kuhnnehn reagent to the sample, add 20 ml of potassium iodide solution, swirl two or three times, add 20 ml of water, swirl again, stopper the flask, and allow it to stand for one minute. Titrate the released iodine with standard sodium thiosulphate solution, add 2 ml of starch solution towards the end of the titration. Carry out a blank test simultaneously under similar experimental conditions.

A-8.2.3 Calculation — Calculate the iodine value as follows:

$$\text{Iodine value} = \frac{12.69 (B - V) \times N}{W}$$

where

B = millilitres of standard sodium thiosulphate solution required for titration of the blank,

V = millilitres of standard sodium thiosulphate solution required for titration of the sample,

N = normality of the standard sodium thiosulphate solution, and

W = mass in g of the sample taken for test.

A-8.2.4 Express the mean of the two iodine values as the iodine value of the material.

A-9. DETERMINATION OF POLYMERIZATION TIME

A-9.0 Principle — It is the time taken by de-hydrated cashewnut shell liquid to gel after the addition of concentrated sulphuric acid in diethyl sulphate.

A-9.1 Reagents

A-9.1.1 Concentrated Sulphuric Acid

A-9.1.2 Diethyl Sulphate

NOTE — Diethyl sulphate is poisonous and should be handled with care.

A-9.2 Procedure

9.2.1 Dehydration of Material — Pour 50 g of the material into a 250-ml beaker (see IS : 2619-1971*) and heat slowly to $205 \pm 5^\circ\text{C}$ with continuous stirring till foaming ceases.

A-9.2.2 Polymerization Test — Take 5.0 ± 0.1 g of the dehydrated oil into a 150×15 mm test-tube (see IS : 2618-1963†). Add through a dropping pipette 0.5 ml of 25 percent solution (*v/v*) of concentrated sulphuric acid in diethyl sulphate and stir the mixture thoroughly with a glass rod of three millilitres in diameter and rounded at the end. Make sure that a thorough mixture is obtained after the addition of the sulphuric acid-diethyl sulphate solution, to avoid local resin formation, which would vitiate the result. Insert the tube into an oil bath which has been heated to $176 \pm 1^\circ\text{C}$ and note the time of insertion with a stop watch. Stir the material slowly. It will be noted that the sample becomes more and more viscous. Note the time when the material suddenly 'gels' or sets to a stiff rubbery pasty mass or a dry rubbery mass. Report the time taken as the polymerization time.

A-10. DETERMINATION OF POLYMERIZATION BY VISCOSITY METHOD

A-10.0 Principle — It is determined by finding out the viscosity of the material when mixed with diethyl sulphate and kept in an oven at $185 \pm 1^\circ\text{C}$ for one hour and finally dissolved in xylene.

A-10.1 Reagents

A-10.1.1 Diethyl Sulphate

NOTE — Diethyl sulphate is poisonous and should be handled with care.

*Specification for glass beakers (*first revision*).

†Specification for test-tubes.

A-10.1.2 Xylene

A-10.2 Procedure — Weigh 200 g of the material into a 500-ml beaker (see IS : 2619-1971*) and add eight grams of diethyl sulphate. Reweigh the beaker and contents. Mix the contents thoroughly and place the beaker in an oven at $185 \pm 1^\circ\text{C}$ for one hour. Remove the beaker from the oven and add 200 g of xylene. Mix well and cool to room temperature. Make up for any loss in xylene so as to have exactly 200 g of xylene in the mixture. Determine the viscosity of the diluted solution at $30 \pm 0.2^\circ\text{C}$ using a U-tube viscometer as prescribed in A-3 or any other suitable viscometer.

A-11. DETERMINATION OF POLYMERIZATION BY VISCOSITY METHOD AFTER ACID WASHING

A-11.0 Principle — It is determined by finding out the viscosity of the material after washing with dilute sulphuric acid which is then mixed with diethyl sulphate and kept in an oven at $185 \pm 1^\circ\text{C}$ for one hour and finally dissolved in xylene.

A-11.1 Reagents

A-11.1.1 Dilute Sulphuric Acid — 5 percent solution.

A-11.1.2 Diethyl Sulphate

NOTE — Diethyl sulphate is a poisonous material and should be handled with care.

A-11.1.3 Xylene

A-11.2 Procedure — Take approximately 500 g of the material in 1 000-ml beaker or flask. Add 200 ml of dilute sulphuric acid and mix thoroughly. Heat the solution on a water-bath maintained at 90 to 95°C for five minutes and then separate the two layers by any suitable method. The separation may best be achieved by centrifuging the hot mixture. Transfer this mixture to the separating funnel and allow it to stand for ten minutes. Discard the lower aqueous layer and collect the upper layer of the cashewnut shell liquid from the separating funnel. Repeat treatment of the separated CNSL layer with sulphuric acid and separate the two layers. Add 200 ml of water to the separated CNSL, mix it thoroughly and heat the mixture to 90 to 95°C for five minutes. Separate the layers by centrifuging or any other suitable method. Test the pH of this aqueous layer. If the pH of the aqueous layer is below five, repeat the treatment of the above separated CNSL layer with further quantity of 200 ml of water till the pH of the aqueous layer obtained is above five. Weigh 200 g of the separated CNSL into a 500-ml beaker (see IS : 2619-1971*) and add eight grams of diethyl

*Specification for glass beakers (first revision).

sulphate. Reweigh the beaker and the contents. Mix the contents thoroughly and place the beaker in an oven maintained at $185 \pm 1^\circ\text{C}$ for one hour. Remove the beaker from the oven and add 200 ml of xylene. Mix well and cool to room temperature. Make up for any loss in xylene so as to have 200 g of xylene in the mixture. Determine the viscosity of the solution at $30 \pm 0.2^\circ\text{C}$ by using the U-tube viscometer as prescribed in A-3 or any other suitable viscometer.

APPENDIX B

(Clause 4.1)

SAMPLING OF CASHEWNUT SHELL LIQUID (CNSL)

B-1. GENERAL REQUIREMENTS OF SAMPLING

B-1.0 In drawing samples the following precautions and directions shall be observed.

B-1.1 As the material is vesicant, care shall be taken in opening the drums for sampling.

B-1.2 Samples shall not be taken in an exposed place.

B-1.3 The sampling instruments shall be clean and dry when used.

B-1.4 Precautions shall be taken to protect the samples, the material being sampled, the sampling instruments and the containers for samples from adventitious contamination.

B-1.5 The samples shall be placed in clean, dry and air-tight glass or other suitable containers on which the material has no action.

B-1.6 The sample containers shall be of such a size that they are almost completely filled by the sample.

B-1.7 Each sample container shall be sealed air-tight after filling and marked with full details of sampling, the date of sampling and the month and year of manufacture of the material.

B-1.8 All sampling instruments, if made of copper, brass or bronze, shall be nickel plated.

B-2. SAMPLING INSTRUMENTS

B-2.1 Sampling Bottle or Can (see Fig. 4) — This instrument is suitable for taking samples from various depths in tanks. It consists of a weighed bottle or metal container with removable stopper or cap, to

which is attached a suitable chain, pole or cord. This device is lowered to the various desired depths at which the stopper is removed and the container is allowed to fill.

B-2.2 Open Type Sampling Tube (see Fig. 5) — It is made of metal or thick glass and may be of 20 to 40 mm diameter and 400 to 800 mm in length (see Note). The upper and lower ends are conical and narrow down to 5 to 10 mm diameter. Handling is facilitated by two rings at the upper end. For taking a sample, the instrument is first closed at the top with the thumb or a stopper and lowered until the desired depth is reached. It is then opened for a short time to admit the material, and finally closed and withdrawn.

NOTE — For small containers, the size of the sampling tube may be altered suitably.

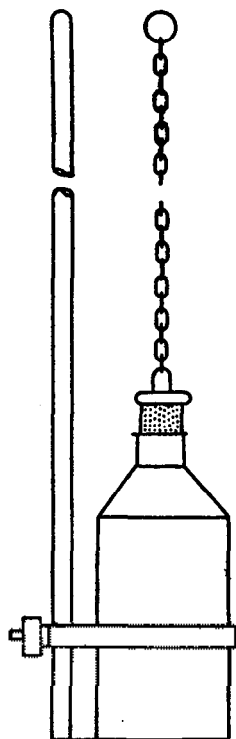
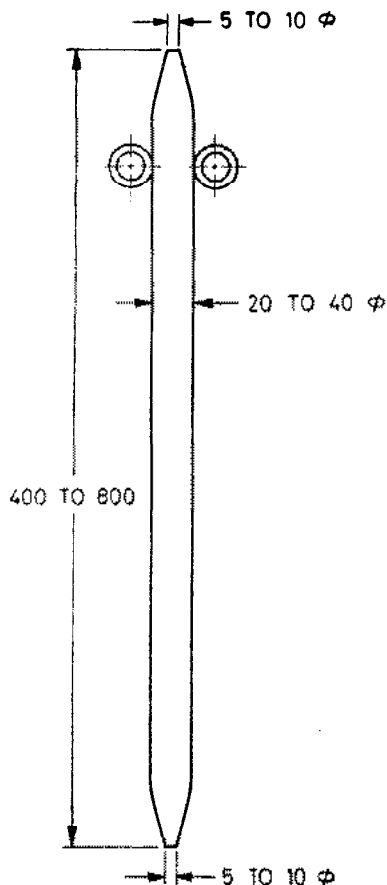


FIG. 4 SAMPLING BOTTLE OR CAN



All dimensions in millimetres.

FIG. 5 OPEN TYPE SAMPLING TUBE

B-3. SCALE OF SAMPLING

B-3.1 Lot — In a single consignment, all the containers of the same size and drawn from the same batch of manufacture shall constitute a lot. If a consignment is known to consist of containers of different sizes or of different batches of manufacture, then the containers belonging to the same size and batch of manufacture shall be grouped together and each such group shall constitute a separate lot. In case the consignment is in tanks, the tanks belonging to the same batch of manufacture shall constitute a lot.

B-3.1.1 For ascertaining the conformity of the lot to the requirements of the specification, tests shall be carried out for each lot separately.

B-3.2 Sampling from Containers — The number (n) of containers to be selected for sampling shall depend on the size (N) of the lot and shall be in accordance with Table 3. In the case of very small lots where the selection of three containers may be uneconomical, the method of judging the conformity of the lot to the requirements of the specification shall be as agreed to between the purchaser and the supplier.

TABLE 3 SCALE OF SAMPLING FOR CONTAINERS

| SIZE OF THE LOT N | NUMBER OF CONTAINERS TO BE SELECTED n |
|---------------------------|---|
| (1) | (2) |
| Up to 20 | 3 |
| 21 " 40 | 4 |
| 41 " 80 | 5 |
| 81 " 120 | 6 |
| 121 " 200 | 8 |
| 201 and above | 10 |

B-3.2.1 The containers shall be selected at random and to ensure the randomness of selection, random number tables may be used. In case, such tables are not available, the following procedure may be adopted:

Starting from any container, count them in one order as 1, 2, 3, ..., etc, up to r and so on, where r is the integral part of N/n (N being the lot size and n the number of containers to be selected). Every r th container thus counted shall be withdrawn to give sample for test.

B-3.3 Sampling from Tanks — Each tank in the lot shall be sampled separately for determining the conformity of the lot to the requirements of the specification.

B-4. PREPARATION OF TEST SAMPLES

B-4.1 Test Samples from Containers — To ensure that the samples taken from each container are fairly representative, the contents shall be mixed thoroughly by shaking or stirring or rolling. Draw small samples of the material from various depths with the help of the sampling tube (see Fig. 5). The approximate quantity of the material to be drawn from a container shall nearly be equal to thrice the quantity required for test purposes.

B-4.1.1 Out of the material drawn from individual containers, a small but equal quantity of material shall be taken and thoroughly mixed to form a composite sample, sufficient for carrying out triplicate determinations for all the characteristics. The composite sample shall be divided into three equal parts, one for the purchaser, another for the supplier and the third for the referee.

B-4.1.2 The remaining portion of the material from each container shall be divided into three equal parts, each forming an individual sample. One set of individual samples representing the n containers selected shall be for the purchaser, another for the supplier and the third for the referee.

B-4.1.3 All the individual and composite samples shall be transferred to separate sample containers. These containers shall then be sealed airtight with stoppers and labelled with full identification particulars given in B-1.7.

B-4.1.4 The referee samples, consisting of a composite sample and a set of n individual samples, shall bear the seals of both the purchaser and the supplier. They shall be kept at a place agreed to between the two, to be used in case of any dispute.

B-4.2 Test Samples from Tanks

B-4.2.1 For drawing a sample from a tank, lower the closed sampling bottle or can (*see B-2.1*) slowly to the required depth, open and fill it at that depth. Three samples shall be obtained at levels of one-tenth of the depth of the liquid from the top surface (top sample), one-half of the depth (middle sample) and nine-tenths of the depth of the liquid from the top surface (lower sample). All the three samples thus obtained from a tank shall be mixed together in a clean dry container and shall be divided into three equal parts, one for the purchaser, another for the supplier and the third for the referee. Each tank in the lot shall be sampled in the above manner and separate samples obtained from each tank. The approximate quantity of the material to be drawn from a tank shall nearly be equal to thrice the quantity required for carrying out tests for the requirement prescribed in this standard.

B-4.2.2 All the samples thus obtained from tanks in the lot shall be transferred to separate containers. These containers shall then be sealed airtight with stoppers and labelled with full identification particulars given in B-1.7.

B-4.2.3 The referee test samples, consisting of the samples from the tanks in the lot, shall bear the seals of both the purchaser and the supplier. They shall be kept at a place agreed to between the two, to be used in case of any dispute.

B-5. NUMBER OF TESTS

B-5.1 For Samples from Containers

B-5.1.1 Test for the determination of iodine value shall be conducted on each of the individual samples separately.

B-5.1.2 Tests for the determination of all the remaining characteristics in the specification shall be conducted on the composite sample.

B-5.2 For Samples from Tanks — Tests for the determination of all the characteristics in the specification shall be conducted on the samples from different tanks separately.

B-5.3 Criteria for Conformity

B-5.3.1 For Containers

B-5.3.1.1 *For individual samples* — For the iodine value which shall be determined on the individual samples, the mean (\bar{X}) and range (R) of the test results shall be calculated as follows:

$$\text{Mean } (\bar{X}) = \frac{\text{the sum of the test results}}{\text{number of the test results}}$$

$$\text{Range } (R) = \text{the difference between the maximum and the minimum values of the test results}$$

Note — For declaring the conformity of the lot to the requirement of iodine value, the value of the expressions ($\bar{X} - 0.6 R$) as calculated from the relevant test, results shall be not less than 250 or 375, as the case may be.

B-5.3.1.2 *For composite samples* — For declaring the conformity of the lot to the requirements of all the other characteristics determined on the composite samples, the test results for each of the characteristic shall satisfy the relevant requirements given in the specification.

B-5.3.2 For Tanks

B-5.3.2.1 The lot shall be declared as conforming to the specification requirements of various characteristics, if each of the test results satisfies individually the relevant requirements specified in the standard.

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI 110002

Telephones : 331 01 31, 331 13 75

Telegrams : Manaksanatha
(Common to all offices)

Regional Offices:

| | Telephones |
|---|------------------------------------|
| Central : Manak Bhavan, 9 Bahadur Shah Zafar Marg, NEW DELHI-110002 | [331 01 31 331 13 75 |
| *Eastern : 1/14 C.I.T. Scheme VII M, V. I. P. Road, Maniktola, CALCUTTA 700054 | 36 24 99 |
| Northern : SCO 445-446, Sector 35-C, CHANDIGARH 160038 | [2 18 43 3 18 41 |
| Southern : C. I. T. Campus, MADRAS 600113 | { 41 24 42 41 25 19 41 29 16 |
| †Western : Manakalaya, E9 MIDC, Marol, Andheri (East), BOMBAY 400093 | 6 32 92 95 |

Branch Offices:

| | |
|---|------------------------|
| 'Pushpak' Nurmohamed Shaikh Marg, Khanpur, AHMEDABAD 380001 | [2 63 48 2 63 49 |
| †Peenya Industrial Area, 1st Stage, Bangalore Tumkur Road BANGALORE 560058 | [38 49 55 38 49 56 |
| Gangotri Complex, 5th Floor, Bhadbhade Road, T. T. Nagar, BHOPAL 462003 | 6 67 10 |
| Plot No. 82/83, Lewis Road, BHUBANESHWAR 751002 | 5 36 27 |
| 53/5, Ward No. 29, R. G. Barua Road, 5th Byslane, GUWAHATI 781003 | 3 31 77 |
| 5-8-56C L. N. Gupta Marg (Nampally Station Road), HYDERABAD 500001 | 23 10 83 |
| R14 Yudhister Marg, C Scheme, JAIPUR 302005 | [6 34 71 6 98 32 |
| 117/418 B Sarvodaya Nagar, KANPUR 208005 | [21 68 76 21 82 92 |
| Patliputra Industrial Estate, PATNA 800013 | 6 23 05 |
| T.C. No. 14/1421, University P.O., Palayam TRIVANDRUM 695035 | [6 21 04 6 21 17 |

Inspection Office (With Sale Point) :

| | |
|--|---------|
| Pushpanjali, 1st Floor, 205-A West High Court Road, Shankar Nagar Square, NAGPUR 440010 | 2 51 71 |
| Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005 | 5 24 35 |

*Sales Office in Calcutta is at 5 Chowringhee Approach, P.O. Princep Street, Calcutta 700072 27 68 00

†Sales Office in Bombay is at Novelty Chambers, Grant Road, Bombay 400007 89 65 28

‡Sales Office in Bangalore is at Unity Building, Narasimharaja Square Bangalore 560002 22 36 71