Australian Government

National Measurement Institute

Bradfield Road, West Lindfield NSW 2070

General Certificate of Approval

NMI 15/4/0

Issued by the Chief Metrologist under Regulation 60
of the
National Measurement Regulations 1999

This is to certify that an approval for use for trade has been granted in respect of the instruments herein described.

Polarimeter (Pol) Tubes used in Self-indicating Polarimetric Saccharimeters to set Optical Length

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

This approval becomes subject to review on 1/03/18, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern approved – certificate issued	15/02/13

CONDITIONS OF APPROVAL

General

There shall be an indication of conformity to this General Certificate of Approval.

It is the responsibility of the manufacturer or their agent to ensure that all instruments purporting to comply with this approval number are constructed in accordance with this General Certificate of Approval and its Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with document NMI P 106.

Signed by a person authorised by the Chief Metrologist to exercise their powers under Regulation 60 of the *National Measurement Regulations 1999.*

Dr A Rawlinson

TECHNICAL SCHEDULE No 15/4/0

1. Description of Pattern   approved on 15/02/13

Polarimeter (pol) tubes to be used in self-indicating polarimetric saccharimeters (in accordance with the ICUMSA International Sugar Scale).

The approved apparatus must comply with the requirements of OIML R14:1995 clause 8 as indicated below.

1.1 General

Polarimeter tubes can be simple or with a circulating solution and, in both cases, with or without a thermostatic sheath. It must be possible to fill them completely without leaving any air bubbles likely to affect the path of the light rays.

In tubes with a removable thermostatic sheath, it must be possible to dismantle and reassemble this sheath easily without affecting the length of the tube by more than the tolerances given in columns 2 and 3 of Table 1. In tubes with a circulating solution, the entry and exit points of the solution must be as near the ends as possible.

For glass tubes with threaded metal collars – the ends of the tubes must extend from 0.2 mm to 1 mm beyond the supporting collars centring the tube, such that a cover glass paced over the end of the tube does not touch any other part of the tube.

Tubes must be made of materials resistant to chemical cleaning products, whether these products are of high pH or low (e.g. 50% acetic acid) and their construction must allow manual external and internal cleaning.

1.2 Lengths and Accuracy Classes

The nominal tube lengths must be a minimum of 10 mm at the reference temperature of 20°C.

According to the accuracy of the adjustment of their true length to the nominal value of this length, the tubes are divided into three classes of accuracy given in columns 2a, 2b and 3 of Table 1 which gives, as example, five lengths in current use. The values of the characteristics shown in Table 1 corresponding to the nominal lengths chosen as examples. For different lengths, the values are calculated by interpolation and rounding.

At 20°C, the measured length of a tube must not differ from its nominal value by more than the permissible deviation given for its class of accuracy. If the difference between the measured length and the nominal length is less than the permissible deviation shown in column 2, this tube need not bear an indication of its measured length.

1.3 Internal Tube Diameter

The internal tube diameter must not exceed 10 mm. All precautions must be taken to reduce internal reflections (particularly in long, small diameter tubes).

1.4 Refilling of Tubes with a Circulating Solution

Tubes with a circulating solution must have dimensions and a construction such that these tubes can be refilled (total replacement of the contained solution) without the total error of measurement exceeding the maximum permissible error for the class of accuracy of the saccharimeter.

1.5 End Faces of the Tubes

1.5.1 Quality of Surface Finish

The plane end faces of glass tubes must be of good optical quality. The plane end faces of tubes of materials other than glass must be ground. In all cases, the surface condition of these faces must be such that the mean arithmetic roughness characterising this condition does not exceed in any direction the values shown in column 4 of Table 1.

1.5.2 Flatness, Parallelism and Perpendicularity to Tube Axis

The end faces must be plane, parallel to each other, perpendicular to the tube axis within the limits shown in columns 5, 6 and 7 of Table 1.

TABLE 1 – Characteristics of Polarimeter (Pol) Tubes

Nominal length, L (mm)	Accuracy class and admissible deviation, ΔL, between the measured length and the nominal length			Plane end faces maximum permissible errors			
	Class 0.01 $\Delta L/L$ = 0.01% (±μm)	Class 0.03 $\Delta L/L$ = 0.03% (±μm)	Class 0.2 $\Delta L/L$ = 0.2% (±μm)	Maximum roughness R_a (#) (μm)	Flatness (μm)	Parallelism (μm)	Perpendicularity to tube axis (minutes of angle)
Column 1	Column 2a	Column 2b	Column 3	Column 4	Column 5	Column 6	Column 7
10	1	3	20	0.2	1	1	2
20	2	6	40	0.3	1	2	3
50	5	15	100	0.4	2	4	4
100	10	30	200	0.6	3	6	6
200	20	60	400	0.8	4	8	8

(#) R_a is the mean arithmetic deviation of the average line of the profile (see ISO R 468-1966)

1.6 Mounting of the Tubes

The tubes and their mountings must be such that, when mounted in the corresponding saccharimeter, they do not cause disturbance of the light rays, and the tube axis coincides with the optical axis of the saccharimeter to within 0.5°.

1.7 Cover Glasses

The thickness of the cover glasses at the tube ends must be between 1 and 2 mm. Their faces must have a good optical finish and they must be flat to within 0.01% of the length of the shortest tube with which they are to be used. The parallelism of the two faces must be such that their angle is less than 5'.

These glasses must be sufficiently free from internal strain so that the saccharimeter indication does not vary by more than 0.01 °Z in the following cases:

• when one cover glass of an empty tube is rotated in relation to the other between 0° and 180°;

• when the empty tube with its glasses is rotated around its axis between 0° and 180° (or, if the tube cannot rotate in this way, when only the two glasses are rotated simultaneously).

1.8   Descriptive Markings

Each tube must bear the following markings, in a clearly legible and indelible manner:

- mark of the manufacturer or submittor

- serial number

- class of accuracy represented by the accuracy of its length (e.g. $\Delta L/L$ = 0.01% or Class 0.01)

- nominal length (see clause 1.2)

- pattern approval mark 'NMI 15/4/0' (may be placed on the collar)

1.9   Additional requirements for trade use

Class 0.01 or Class 0.03 pol tubes shall be used when measuring the optical rotation of cane juice for payment purposes.

1.10   Verification

A pol tube will be presumed to comply with the above requirements provided that:

- it bears the markings in clause 1.8, and

- it is marked by a trade measurement inspector or Servicing Licensee indicating that it passes the test for internal length.

TEST PROCEDURE No 15/4/0

Internal length of pol tube

Pol tubes used with the saccharimeter shall fulfil the admissible deviation (ΔL) for accuracy Class 0.03 or Class 0.01 as evidenced by a measurement report issued by an NMI Verifying Authority for length.

The sum of uncertainties and variations associated with the length measurement method must not be greater than one-third of the ΔL for the accuracy class.

TABLE 2

Nominal length, L (mm)	Accuracy class and admissible deviation, ΔL, between the measured length and the nominal length		
	Class 0.01 $\Delta L/L$ = 0.01% ($\pm\mu m$)	Class 0.03 $\Delta L/L$ = 0.03% ($\pm\mu m$)	Class 0.2 $\Delta L/L$ = 0.2% ($\pm\mu m$)
10	1	3	20
20	2	6	40
50	5	15	100
100	10	30	200
200	20	60	400

Keep a record of the following information for each pol tube marked:

- Tube serial number

- Highest (best) accuracy class

- Identifier of length measurement report.

Strain in cover glasses

Check at least one pair of cover glasses used with the tube for strain. Two methods are permitted.

Record the result for at least one pair of cover glasses.

(A)   Strain Viewer Method

Examine each cover glass under a strain viewer. Glasses with negligible internal strain will result in no dispersion of light while those having strain will cause dispersion.

(B)   Saccharimeter Indication Method

Place an empty tube with two cover glasses in the saccharimeter. Observe any changes in the indication in the following cases:

(a)   Glass 1 is fixed, glass 2 is rotated 90°.

(b)   Glass 1 is fixed, glass 2 is further rotated 90° in the same direction.

(c)   Glass 2 is fixed, glass 1 rotated 90° in the opposite direction to (a).

(d)   Glass 2 is fixed, glass 1 is further rotated 90° in the same direction.

(e)   Glass 1 and glass 2 are rotated 90° simultaneously (or if possible, the empty tube is rotated around its axis 90°).

(f)   Glass 1 and glass 2 (or the pol tube) are rotated a further 90° in the same direction.

In all cases (a) – (f), the indication shall not vary by more than 0.01 °Z from the first recorded reading.

Discard any cover glasses that affect the indication or that may be under too much strain.

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