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N O R M A D E M E T R O L O G I E L E G A L Ă

Refractometre pentru măsurarea conţinutului de zahăr în sucurile de fructe

Ediţie oficială

Chişinău

AUTORITATEA CENTRALĂ DE METROLOGIE
NORMA DE METROLOGIE LEGALĂ **NML R 108:2013**

Refractometre pentru măsurarea conţinutului de zahăr în sucurile de fructe

(OIML R 108:1993, IDT)

Refractometers for the measurement of the sugar content of fruit juices

APROBARE | Aprobată prin Ordinul Ministerului Economiei nr. 120 din 02 iulie 2013

DESCRIPTORI | Refractometre, încercări verificări metrologice

Preambul naţional

Prezenta normă de metrologie legală reprezintă adoptarea recomandării Organizaţiei Internaţionale de Metrologie Legală R 108 „Refractometers for the measurement of the sugar content of fruit juices”.

Prezenta recomandare a OIML se completează cu un nou capitol, cu următorul cuprins:

„Capitolul 13 Întocmirea rezultatelor verificării metrologice

13.1 Dacă în baza rezultatelor verificărilor metrologice iniţiale, periodice sau după reparare mijlocul de măsurare este recunoscut ca utilizabil, atunci pe el se aplică marcajul metrologic de verificare şi se eliberează buletin de verificare metrologică de strictă evidenţă. Rezultatele verificării metrologice sînt valabile pe durata intervalului maxim de timp admis între două verificări metrologice periodice, conform Listei Oficiale a mijloacelor de măsurare supuse controlului metrologic legal.

13.2 Dacă în baza rezultatelor verificărilor metrologice iniţiale, periodice sau după reparare mijlocul de măsurare este recunoscut ca inutilizabil atunci se eliberează buletin de inutilizabilitate.”

Titlul prezentului regulament general de metrologie legală în limba rusă:
Рефрактометры для измерения содержания сахара в фруктовых соках.

1. Elementele naţionale ale prezentei norme de metrologie legală au fost elaborate de Institutul Naţional de Standardizare şi Metrologie.

2. Modificări după publicare:

Indicativul modificării	Revista „metrologie” nr./an	Punctele modificate

ORGANISATION INTERNATIONALE

DE MÉTROLOGIE LÉGALE

INTERNATIONAL RECOMMENDATION

Refractometers for the measurement of the sugar content of fruit juices

Réfractomètres pour la mesure de la teneur en sucre des jus de fruits

OIML R 108

Edition 1993 (E)

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FOREWORD

The International Organization of Legal Metrology (OIML) is a worldwide, intergovernmental organization whose primary aim is to harmonize the regulations and metrological controls applied by the national metrological services, or related organizations, of its Member States.

The two main categories of OIML publications are:

1) **International Recommendations (OIML R),** which are model regulations that establish the metrological characteristics required of certain measuring instruments and which specify methods and equipment for checking their conformity; the OIML Member States shall implement these Recommendations to the greatest possible extent;

2) **International Documents (OIML D),** which are informative in nature and intended to improve the work of the metrological services.

OIML Draft Recommendations and Documents are developed by technical committees or subcommittees which are formed by the Member States. Certain international and regional institutions also participate on a consultation basis.

Cooperative agreements are established between OIML and certain institutions, such as ISO and IEC, with the objective of avoiding contradictory requirements; consequently, manufacturers and users of measuring instruments, test laboratories, etc. may apply simultaneously OIML publications and those of other institutions.

International Recommendations and International Documents are published in French (F) and English (E) and are subject to periodic revision.

OIML publications may be obtained from the Organization's headquarters:

Bureau International de Métrologie Légale
11, rue Turgot - 75009 Paris - France
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Fax: 33 (1) 42 82 17 27
Telex: 234 444 SVP SERV F ATTN OIML

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This publication - reference OIML R 108, edition 1993 (E) - was developed by the OIML working groups SP 18-Sr 7 "Refractometers for measuring the sugar content of fruit juices or other food products" and SP 18 "Measurement of characteristics of food products". It was sanctioned by the International Conference of Legal Metrology in 1992.

REFRACTOMETERS for the MEASUREMENT of the SUGAR CONTENT of FRUIT JUICES

1 Scope

This Recommendation applies to refractometers used to determine the mass fraction of sugars (sucrose, invert-sugar, glucose, fructose) in fruit juices by measuring their refractive indices.

Note: For the purposes of this Recommendation, fruit juices are considered as solutions of sucrose in water. Other components and the differences between the various kinds of sugars are neglected.

2 Terminology

2.1 Refractometers are instruments for measuring the refractive index. If they are provided with appropriate scales, they are used to determine the content of sugar in liquids, in which case the relation between the mass fraction and the refractive index shall have been specified (see 3).

2.2 Hand refractometers and Abbe refractometers are instruments in which the liquid sample is applied manually to the measuring surface, the indication being read from a scale.

2.3 Automatic refractometers are instruments in which the liquid sample is supplied to the device automatically, the indication being displayed or printed.

2.4 Semiautomatic refractometers are instruments in which the liquid sample is not supplied automatically, the indication being nevertheless displayed or printed.

2.5 Process refractometers are instruments in which the liquid is continuously supplied as a function of product transport but not as a feature of the instrument. The measuring procedure is performed independently of the liquid transport.

3 Units

3.1 The refractive index n of a medium is the ratio of the velocity of light in standard air to the velocity of light in the medium; it is a dimensionless quantity (or of dimension 1).

3.2 The mass fraction of sucrose in aqueous solutions is the ratio of the mass of sucrose, in grams, to the mass of the solution, in grams, and shall be expressed in per cent with the symbol "% mas". (The indication "mas" behind "%" is used to avoid misunderstandings, as "%" may also be used for the volume fraction - "% vol" - of a solution).

4 Adjustment

The values adopted and published by the ICUMSA (International Commission for Uniform Methods of Sugar Analysis, Proceedings of the 16th Session of ICUMSA, 1974, page 144, with a typing error corrected in the Proceedings of the 17th Session of ICUMSA, 1978, page 166) are valid for the relation between the mass fraction of sucrose in sucrose-water solutions and the refractive index n for the wavelength λ = 589.3 nm at a temperature of 20 °C.

5 Inscriptions and markings

5.1 The following shall be marked indelibly on the refractometer:

a) the name or trade mark of the manufacturer or representative
b) the serial number
c) the measuring range
d) the year of production

5.2 The following shall be marked indelibly on the scales:

a) scale for refractive index, the symbol "n_D"
b) scale for the mass fraction, the designation "% mas"
c) for scales marked according to (b), the type of liquid for which the refractometer has been adjusted (e.g.: aqueous solutions for which the relation between the refractive index and the mass fraction is known and has been published by national bodies or by international commissions such as ICUMSA)

Note: If the refractometer shows clearly and unmistakably the inscriptions according to 5.2(a) - 5.2(c), the signs "n" and "%" are sufficient on the scale.

5.3 When the refractometer is intended to be used for solutions with high absorption, the maximum allowable absorption for a safe measurement should be given.

6 Maximum permissible errors

6.1 The maximum permissible errors on verification are the following:

– for analogue scales: ± 0.5 scale interval
– for digital scales: ± 1 scale interval

6.2 The indication for distilled water at 20.0 °C shall not deviate by more than 0.2 scale interval from the following nominal values:

Measurand	Nominal value
Refractive index	1.33299
Mass fraction	0 %

7 Space for protective marks

To avoid accidental or illicit maladjustment of the scale and other adjustment features of the instrument, space for protective marks shall be provided on the adjusting devices and on those parts of the instrument for which the indication of the instrument is sensitive to interference.

8 Materials

8.1 Refractometers shall be made from materials that will not be adversely affected by the liquid samples and other substances with which they may enter into contact during the measurement.

8.2 The optical components shall be made of adequately transparent, homogeneous and solid materials so that the performance and correctness of measurement of the device are guaranteed over a sufficiently long period of time.

9 Constructional requirements

9.1 Adjusting devices and all parts of the instrument which may influence the result of measurement shall be protected against drift.

9.2 It shall be possible to adjust the eyepiece smoothly, at least in the range from + 2 diopters to – 5 diopters. With the same adjustment of the eyepiece, the border line between light and dark areas and the scale shall be sharply imaged. If the border line is directly imaged on the scale, border line and scale marks shall be parallel. If the border line is brought into coincidence with cross hairs (Abbe refractometer), it shall be symmetrical with the cross lines in the parfocalized state.

During normal use, eyepiece and scales shall be protected against moisture.

9.3 The prism and the liquid sample may be illuminated either by daylight or by means of an illuminating system using an appropriate source of light. However, the reference wavelength λ = 589.3 nm should be used for the measurement, e.g. by use of an appropriate filter. If a different wavelength of light is used, the scales for mass fraction shall be corrected taking into account the dispersion and the dependence of the dispersion on the mass fraction of the liquid sample used.

The cover of the illumination prism shall be easy to operate and remain automatically closed during measurement.

9.4 With certain types of refractometers, a thermostat may be used to maintain constant temperature of the liquid sample and the prism.

10 Scales

10.1 General

10.1.1 Not more than two scales, each with a scale numbering, may appear in the field of view. These scales shall be clearly separated by a certain distance or by an intermediate continuous line.

10.1.2 The scale interval for the refractive index shall not be greater than 1×10^{-3}.

10.1.3 The scales may bear an intelligible abbreviation to indicate the types of liquids (see 5.2).

10.2 Hand refractometers

10.2.1 One scale shall indicate the refractive index or the mass fraction of sucrose in sucrose-water solutions.

10.2.2 The measuring range shall extend from the reference point for distilled water to the maximum scale value. However, the measuring range does not need to be graduated over its full length: a nongraduated section of the measuring range (range of interruption) is permissible between the reference point for distilled water and the minimum scale value; in this case, there shall be an auxiliary division of at least two lines or numbers on both sides of the reference point.

Explanation: Sometimes the lower range of the scale is not defined by a table according to 5.2.c; however, the zero point, namely the refractive index for distilled water, shall be indicated for adjustment and control purposes.

10.2.3 In the case of scales for the mass fraction, the scale interval shall be:

- for analogue scales: 0.1 %, 0.2 %, or 0.5 %
- for digital scales: 0.1 %

10.3 Abbe refractometers

10.3.1 One scale shall indicate the refractive index.

10.3.2 In the case of additional scales for the mass fraction, the scale interval shall not be greater than 0.5 %.

10.4 Adjustment values

Table 1 below gives the abovementioned ICUMSA values.

11 Thermometers

11.1 Refractometers without an automatic temperature correction device should be equipped with thermometers to measure the temperature of the test prism.

If a thermostat is connected for thermalizing the test prism, the thermometer shall indicate the temperature of the prism.

11.2 The temperature shall be indicated in Celsius degrees (symbol: °C).

11.3 The scale interval shall be 1 °C or 2 °C; in the case of Abbe refractometers, 0.1 °C, 0.2 °C, and 0.5 °C are also acceptable.

11.4 The measuring range shall include the interval from at least 10 °C to 30 °C.

11.5 The maximum permissible errors on verification of the thermometer are one scale interval (plus or minus) for hand refractometers and ± 0.5 °C for Abbe refractometers.

11.6 In addition to the temperature in Celsius degrees, the device for measuring the temperature of hand refractometers shall also indicate the values of the temperature correction, which are given in Table 2. On the refractometer or in its instructions for use, it shall be pointed out that these correction values refer to solutions of sucrose in water.

12 Metrological control

When refractometers for fruit juices and fruit-juice concentrates are subject to State control for any given country, this control shall include all or part of the following operations, according to the national regulations.

12.1 Pattern approval

12.1.1 Each pattern of refractometer from each manufacturer shall be subject to pattern approval.

12.1.2 The construction of an instrument of a pattern that has been already approved may not be changed without approval.

12.2 Verification

Every new, repaired, or readjusted refractometer shall be subject to verification.

12.3 Periodic supervision

The metrological characteristics of each refractometer shall be checked periodically.

12.4 The conditions of these controls shall be specified by the national regulations of each country.

12.5 To signify that the instrument has been the object of official control, visible check marks shall be affixed on the instrument without adversely affecting its use.

Table 1
Adjustment values of refractometers for the mass fraction of sucrose in sucrose-water solutions at 20 °C

mass fraction %	refraction index n_D	mass fraction %	refraction index n_D	mass fraction %	refraction index n_D
0	1.33299	30	1.38115	60	1.44193
1	1.33442	31	1.38296	61	1.44420
2	1.33586	32	1.38478	62	1.44650
3	1.33732	33	1.38661	63	1.44881
4	1.33879	34	1.38846	64	1.45113
5	1.34026	35	1.39032	65	1.45348
6	1.34175	36	1.39220	66	1.45584
7	1.34325	37	1.39409	67	1.45822
8	1.34476	38	1.39600	68	1.46061
9	1.34629	39	1.39792	69	1.46303
10	1.34782	40	1.39986	70	1.46546
11	1.34937	41	1.40181	71	1.46790
12	1.35093	42	1.40378	72	1.47037
13	1.35250	43	1.40576	73	1.47285
14	1.35408	44	1.40776	74	1.47535
15	1.35568	45	1.40978	75	1.47787
16	1.35729	46	1.41181	76	1.48040
17	1.35891	47	1.41385	77	1.48295
18	1.36054	48	1.41592	78	1.48552
19	1.36218	49	1.41799	79	1.48810
20	1.36384	50	1.42009	80	1.49071
21	1.36551	51	1.42220	81	1.49333
22	1.36720	52	1.42432	82	1.49597
23	1.36889	53	1.42647	83	1.49862
24	1.37060	54	1.42862	84	1.50129
25	1.37233	55	1.43080	85	1.50398
26	1.37406	56	1.43299		
27	1.37582	57	1.43520		
28	1.37758	58	1.43743		
29	1.37936	59	1.43967		

Table 2
Temperature correction values of a refractometer
for measuring sucrose-water solutions referring to 20 °C
and a wavelength λ = 589,3 nm

Temp. °C	mass fraction %																	
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
	to be subtracted from the mass fraction																	
10	0.52	0.56	0.59	0.61	0.64	0.67	0.69	0.71	0.72	0.74	0.74	0.74	0.75	0.76	0.77	–	–	–
11	0.48	0.51	0.54	0.55	0.58	0.61	0.63	0.65	0.65	0.67	0.67	0.67	0.68	0.68	0.69	–	–	–
12	0.44	0.47	0.49	0.50	0.52	0.55	0.57	0.58	0.58	0.60	0.60	0.60	0.60	0.61	0.61	–	–	–
13	0.39	0.42	0.43	0.44	0.46	0.49	0.50	0.51	0.51	0.53	0.53	0.53	0.53	0.53	0.53	–	–	–
14	0.35	0.37	0.38	0.39	0.40	0.42	0.43	0.44	0.44	0.45	0.45	0.45	O.45	0.45	0.46	–	–	–
15	0.29	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.37	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.37	0.37
16	0.24	0.25	0.26	0.27	0.28	0.28	0.29	0.30	0.30	0.30	0.31	0.31	0.31	0.31	0.31	0.30	0.30	0.30
17	0.18	0.19	0.20	0.20	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.22
18	0.12	0.13	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
19	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07
	to be added to the mass fraction																	
21	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07
22	0.13	0.14	0.14	0.14	0.14	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15
23	0.20	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22
24	0.27	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.31	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.30
25	0.34	0.35	0.36	0.37	0.38	0.38	0.39	0.39	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.38	0.37
26	0.42	0.43	0.44	0.45	0.46	0.46	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.45
27	0.50	0.51	0.52	0.53	0.54	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.56	0.55	0.55	0.54	0.53	0.52
28	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.64	0.64	0.65	0.65	0.64	0.64	0.64	0.63	0.62	0.61	0.60
29	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.73	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.69	0.68
30	0.74	0.75	0.77	0.78	0.79	0.80	0.81	0.81	0.81	0.82	0.81	0.81	0.81	0.80	0.79	0.78	0.77	0.75

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