INTERNATIONAL STANDARD (ISO) 1768

Glass hydrometers — Conventional value for the thermal cubic expansion coefficient (for use in the preparation of measurement tables for liquids)

Aréomètres en verre — Valeur conventionnelle pour la dilatabilité volumique thermique (à utiliser lors de l'établissement des tables de mesurage des liquides)

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

Prior to 1972, the results of the work of the Technical Committees were published as ISO Recommendations; these documents are now in the process of being transformed into International Standards. As part of this process, Technical Committee ISO/TC 48 has reviewed ISO Recommendation R 1768 and found it technically suitable for transformation. International Standard ISO 1768 therefore replaces ISO Recommendation R 1768-1970 to which it is technically identical.

ISO Recommendation R 1768 was approved by the Member Bodies of the following countries :

Austria	India	South Africa, Rep. of
Belgium	Iran	Spain
Canada	Ireland	Thailand
Colombia	Israel	Turkey
Czechoslovakia	Italy	United Kingdom
Egypt, Arab Rep. of	Netherlands	U.S.A.
France	New Zealand	Yugoslavia
Germany	Peru	
Greece	Poland	

No Member Body expressed disapproval of the Recommendation.

No Member Body disapproved the transformation of ISO/R 1768 into an International Standard.

Glass hydrometers — Conventional value for the thermal cubic expansion coefficient (for use in the preparation of measurement tables for liquids)

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies, for use in the preparation of measurement tables for liquids, a conventional value for the thermal cubic expansion coefficient of glass hydrometers. It states how the indications of hydrometers having a thermal cubic expansion coefficient differing from the recommended conventional value may be corrected for use in connection with measurement tables in the construction of which the conventional value has been used.

2 APPLICABILITY OF COEFFICIENT

Measurement tables for liquids provide means for deriving, from the indications of density and/or relative density hydrometers at various temperatures, the corresponding value of the density and/or relative density with respect to water of the liquid at a reference temperature. In principle such measurement tables must take account of the thermal expansion of the hydrometers. Since hydrometers are made of various glasses, their expansion coefficients differ. Consequently, it is desirable to use a single, conventional thermal cubic expansion coefficient in the construction of measurement tables and to associate with the tables information on how to adjust appropriately to the tables the indication of a hydrometer having any other thermal cubic expansion coefficient.

3 CONVENTIONAL VALUE OF COEFFICIENT

It is recommended that when preparing measurement tables for liquids the thermal cubic expansion coefficient of glass hydrometers should be taken to be 0,000 025/°C.

4 INDICATION OF COEFFICIENT USED

4.1 The thermal cubic expansion coefficient of the hydrometers, namely 0,000 025/°C, used in the construction of measurement tables for liquids shall be stated in the tables.

4.2 It shall be indicated in the measurement tables that hydrometer readings may have to be modified preparatory to using the tables if the thermal cubic expansion coefficient of the hydrometers used differs from 0,000 025/°C

5 USE OF THE TABLES IN ASSOCIATION WITH HYDROMETERS HAVING A THERMAL CUBIC EXPANSION COEFFICIENT DIFFERENT FROM 0,000 025/°C

5.1 General

The relationship between

a) the indication (R) at θ °C of a hydrometer of which the standard temperature is t °C and the thermal expansion is equal to the conventional value 0,000 025/°C, and

b) the indication (R') at θ °C of a hydrometer having the thermal expansion γ/°C, but otherwise similar,

is given by

$$R = R' \left[1 + (0,000\ 025 - \gamma)\ (\theta - t)\right]$$

Consequently, before using measurement tables in the construction of which the coefficient 0,000 025/°C has been used, the hydrometer indication R' at θ °C shall be modified to

$$R' \left[1 + (0,000\ 025 - \gamma)\ (\theta - t)\right]$$

It is apparent that R' may be modified either by multiplying it by

$$1 + (0,000\ 025 - \gamma)\ (\theta - t)$$

or by adding to it

$$R'\ (0,000\ 025 - \gamma)\ (\theta - t)$$

5.2 Applicability to density hydrometers

Assuming that t °C is 20 °C, the preferred standard temperature of density hydrometers complying with ISO/R 649, *Density hydrometers for general purposes*, R' may be modified either by multiplying it by

$$1 + (0,000\ 025 - \gamma)\ (\theta - 20)$$

or by adding to it

$$R'\ (0,000\ 025 - \gamma)\ (\theta - 20)$$

If t °C is 15 °C or 27 °C, the other recommended standard temperatures, these values shall be substituted for 20 °C.

TABLE 1

Values of R' $(0{,}000\ 025 - \gamma)$ $(\theta - t)$ when $(\theta - t) = 1$

Unit : 0,001 g/ml

R'	Value of $(0{,}000\ 025 - \gamma)$		
	0,000 010	0,000 015	0,000 020
0,6	0,006	0,009	0,012
0,7	0,007	0,0105	0,014
0,8	0,008	0,012	0,016
0,9	0,009	0,0135	0,018
1,0	0,010	0,015	0,020
1,1	0,011	0,0165	0,022
1,2	0,012	0,018	0,024

5.3 Applicability to relative density 60/60 °F hydrometers

When relative density 60/60 °F hydrometers are used, it is usual to express the temperature of the liquid in degrees Fahrenheit. The modification formula quoted in 5.1 then becomes

$$R' \left[1 + (0{,}000\ 025 - \gamma) \frac{5}{9} (\theta - 60)\right]$$

where θ °F is the temperature of the liquid and γ still represents the expansion per degree Celsius.

It follows that R' may be modified either by multiplying it by

$$1 + (0{,}000\ 025 - \gamma) \frac{5}{9} (\theta - 60)$$

or by adding to it

$$R' (0{,}000\ 025 - \gamma) \frac{5}{9} (\theta - 60)$$

TABLE 2

Values of R' $(0{,}000\ 025 - \gamma) \frac{5}{9} (\theta - 60)$ when

$(\theta - 60) = 1$ and θ is expressed in degrees Fahrenheit

Unit : 0,001 relative density

R'	Value of $(0{,}000\ 025 - \gamma)$		
	0,000 010	0,000 015	0,000 020
0,6	0,0033	0,0050	0,0067
0,7	0,0039	0,0058	0,0078
0,8	0,0044	0,0067	0,0089
0,9	0,0050	0,0075	0,0100
1,0	0,0056	0,0083	0,0111
1,1	0,0061	0,0092	0,0122
1,2	0,0067	0,0100	0,0133