Method OIV-MA-AS2-01A Type I methods

Density and Specific Gravity at 20°C

1. Definition

Density is the mass per unit volume of wine or must at 20°C. It is expressed in grams per milliliter, and denoted by the symbol $\rho_{20°C}$.

Specific gravity at 20°C (or 2°C/2°C relative density) is the ratio, expressed as a decimal number, of the density of the wine or must at 20°C to the density of water at the same temperature, and is denoted by the symbol $d^{20°C}_{20°C}$

2. Principle

The density and specific gravity at 20°C are determined on the sample under test:

A. by pycnometry, or
B. by electronic densimetry using an oscillating cell
C. or by densimetry with a hydrostatic balance.

Note: For very accurate measurement, the density must be corrected for the presence of sulphur dioxide.

ρ_{20} = ρ'_{20} - 0.0006 x S
ρ_{20} = the corrected density
ρ'_{20} = the observed density
S = total sulphur dioxide in g/l

3. Preliminary treatment of sample

If the wine or the must contains appreciable quantities of carbon dioxide, remove most of this by agitating 250 mL of wine in a 1000 mL flask, or by filtering under reduced pressure through 2 g of cotton wool placed in an extension tube.

4. Density and Specific Gravity at 20°C by pycnometry (Type I method)

4.1. *Apparatus*

Normal laboratory apparatus and in particular:

4.1.1 Pyrex glass pycnometer of approximately 100 mL capacity with a detachable ground glass thermometer graduated in tenths of a degree from 10 to 30°C. The thermometer must be standardized (fig 1).

Any pycnometer that is technically equivalent may be used.

The pycnometer has a side tube 25 mm in length and 1 mm (maximum) in internal diameter ending in a conical ground joint. The side tube may be capped by a "reservoir stopper" consisting of a conical ground-glass joint tube ending in a tapered section. The stopper serves as an expansion chamber.

The two ground joints of the apparatus should be prepared with care.

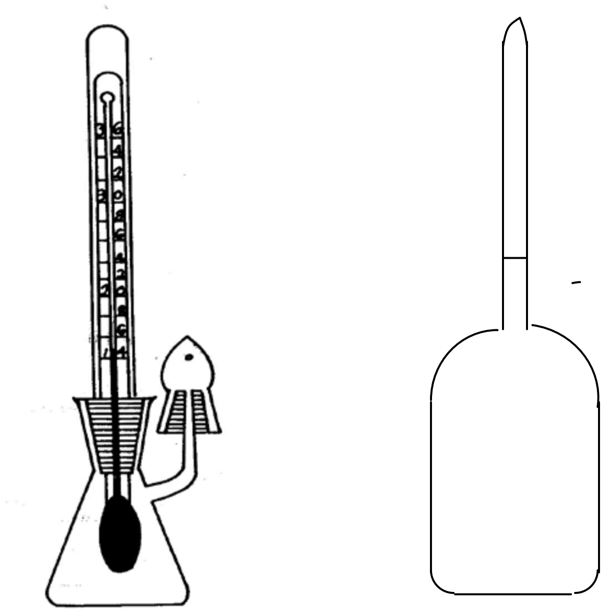

FIGURE 1: Pycnometer with tare flask

4.1.2 A tare flask of the same external volume (to within at least 1 mL) as the pycnometer and with a mass equal to the mass of the pycnometer filled with a liquid of specific gravity 1.01 (sodium chloride solution, 2% (*m/v*)).

A thermally insulated chamber exactly fitting the body of the pycnometer.

4.1.3 A two-pan balance, sensitive to one-tenth milligram, or a single-pan balance, sensitive to one-tenth of a milligram.

4.2. *Calibration of the Pycnometer*

Calibration of the pycnometer involves determination of the following quantities:

- empty tare;
- volume of pycnometer at 20°C;
- mass of water filled pycnometer at 20°C.

4.2.1 Method using a two-pan balance

Place the tare flask on the left-hand pan of the balance and the pycnometer (clean and dry, with its "receiving stopper" fitted) on the right-hand pan, attain a balance by placing marked weights alongside the pycnometer, to give *p* grams.

Carefully fill the pycnometer with distilled water at ambient temperature. Insert the thermometer. Carefully wipe the pycnometer and place it in the thermally insulated container. Mix by inverting the container until the temperature reading on the thermometer is constant. Accurately adjust the level to the upper rim of the side tube. Wipe the side tube and put on the receiving stopper. Read temperature *t*°C with care and if necessary correct for the inaccuracy of the thermometer scale. Weigh the pycnometer full of water, against the tare and record *p'*, the mass in grams that gives an exact balance.

Calculations: *

Tare of the empty pycnometer:

Tare empty = $p + m$ m = mass of air contained in pycnometer

$$m = 0.0012\ (p - p')$$

Volume at 20°C:

$V_{20°C} = (p + m - p') \times F_t$

F_t = factor obtained from Table I for temperature *t*°C

$V_{20°C}$ must be known to the nearest ± 0.001 mL

Mass of water at 20°C:

$M_{20°C} = V_{20°C} \times 0.998203$

0.998203 = density of water at 20°C.

* A worked example is given in the Annex.

4.2.2 *Using a single-pan balance*

Determine:

- mass of clean dry pycnometer: P,
- mass of pycnometer full of water at *t*°C as described in 4.2.1: P_1
- mass of tare flask T_0.

Calculations: *

Taring of the empty pycnometer:

Tare empty pycnometer = P – *m*   *m* = mass of air contained in pycnometer

$m = 0.0012\ (P_1 - P)$

Volume at 20°C:

$V_{20°C} = [P_1 - (P - m)] \times F_t$

F_t = factor obtained from Table I for temperature *t*°C

$V_{20°C}$ must be known to the nearest ± 0.001 mL

Water mass at 20°C:

$M_{20°C} = V_{20°C} \times 0.998203$

0.998203 = density of water at 20°C.

4.3. ***Method of measurement*** *

4.3.1 Using a two-pan balance

Weigh the pycnometer filled with the sample prepared for testing (3) as described in 4.2.1.

Let *p*" be the mass in grams that achieves a balance at *t*°C.
Mass of the liquid in the pycnometer = *p* + *m* - *p*"
Apparent density at *t*°C:

$$\rho_{t^oC} = \frac{p + m - p''}{V_{20^oC}}$$

Calculate the density at 20°C using the appropriate correction table in accordance with the nature of the liquid being measured: dry wine (Table II), natural or concentrated must (Table III), sweet wine (Table IV).

The 20°C/20°C specific gravity of the wine is calculated by dividing the density at 20°C by 0.998203.

4.3.2 Using a single-pan balance *

* A worked example is given in the Annex.

Weigh the tare flask, let its mass be T_1;

Calculate $dT = T_1 - T_0$.

Mass of pycnometer empty at time of measurement = P - *m* + *d*T.

Weigh the pycnometer filled with the sample prepared for the test as described in 4.2.1. Let its mass at *t*°C be P_2

Mass of the liquid in the pycnometer at *t*°C = P_2 - (P - *m* + *d*T).

Apparent density at *t*°C:

$$\rho_{t°C} = \frac{P_2 - (P - m + dT)}{V_{20°C}}$$

Calculate the density at 20°C of the liquid examined (dry wine, natural or concentrated must or sweet wine) using the correction tables as instructed in 4.3.1.

The 20°C/20°C specific gravity is obtained by dividing the density at 20°C by 0.998203.

4.3.3 *Repeatability* for density measurements
of dry and full bodied wines: *r* = 0.00010
of sweet wines: *r* = 0.00018

4.3.4 *Reproducibility* for density measurements
of dry and full bodied wines: R = 0.00037

of sweet wines: R = 0.00045*

5. Density at 20°C and specific gravity at 20°C measured by electronic densimetry using an oscillating cell

5.1. Principle

The density of the wine is measured by electronic densimetry using an oscillating cell. The principle consists of measuring the oscillation frequency of a tube containing the sample and subjected to an electromagnetic field. The density is related to the oscillation frequency by the following equation:

$$\rho = T^2 \times \left(\frac{C}{4\pi^2 V}\right) - \left(\frac{M}{V}\right) \qquad (1)$$

ρ = density of the sample
T = induced oscillation frequency
M = mass of the empty tube
C = spring constant
V = volume of the oscillated sample

This relationship is of the form: $\rho = A\ T^2 - B(2)$, there is therefore a linear relationship between the density and the square of the frequency. The constants A and B are specific for each oscillator and are estimated by measuring the period of fluids of known density.

5.2. Equipment

5.2.1. Electronic oscillating cell densimeter

The electronic densimeter consists of the following elements:

- a measuring cell containing a measuring tube and a temperature controller,
- a system for oscillating the tube and measuring the oscillation frequency,
- a timer,
- a digital display and if necessary a calculator.

The densimeter is placed on a perfectly stable support, isolated from all vibrations.

5.3 Reagents and materials

5.3.1 Reference fluids

Two reference fluids are used to adjust the densimeter. The densities of the reference fluids must include those of the wines to be measured. A difference in density between the reference fluids of more than 0.01000 g/ml is recommended.

The density must be known with an uncertainty of less than +/- 0.00005 g/ml, at a temperature of 20.00 +/- 0.05°C.

The reference fluids used to measure the density of the wines by electronic densimetry are:

- dry air (uncontaminated),
- double distilled water, or water of equivalent analytical purity,
- aqueous-alcoholic solutions, or wines whose density has been determined by pycnometry,
- solutions connected to national standards with a viscosity of less than 2 mm^2/s.

5.3.2 Cleaning and drying products

- detergents, acids, etc.
- organic solvents: ethanol 96% vol., pure acetone, etc.

5.4 Equipment inspection and calibration

5.4.1 Temperature control of measuring cell

The measuring tube is located in a temperature-controlled device. The variation in temperature must be less than +/- 0.02°C.

When provided as a feature by the densimeter, the temperature of the measuring cell must be controlled since it has a significant impact on the results of the determinations. The density of an aqueous-alcoholic solution with an alcoholic strength by volume (ASV) of 10% vol. is 0.98471 g/ml at 20°C and 0.98447 g/ml at 21°C, i.e. a difference of 0.00024 g/ml.

The test temperature is 20°C. The cell temperature is measured with a thermometer that offers a resolution of less than 0.01°C and connected to national standards. It must ensure that the temperature is measured with an uncertainty of less than +/- 0.07°C.

5.4.2 Equipment calibration

The equipment must be calibrated before being used for the first time, then every six months or if the verification is unsatisfactory. The objective is to use two reference fluids to calculate the constants A and B (cf. (2)). For details about the calibration refer to the instructions for the equipment. In principle, this calibration is carried out using dry air (taking atmospheric pressure into consideration) and very pure water (double-distilled and/or microfiltered with a very high resistivity, e.g. > 18 MΩ.cm).

5.4.3 Verifying the calibration

The calibration is verified by measuring the density of the reference fluids.

- An air density verification is performed every day. A difference between the theoretical and measured density of more than 0.00008 g/ml may indicate that the tube is soiled. It must then be cleaned. After cleaning, the air density is verified again, and if this verification does not comply then the equipment must be adjusted.
- The density of water must also be verified; if the difference between the theoretical and measured density is greater than 0.00008 g/ml then the apparatus must be adjusted.
    - If the verification of the cell temperature is problematic then the density of a hydroalcoholic solution whose density is comparable with those of the wines analysed can be checked directly.

5.4.4 Checks

When the difference between the theoretical density of a reference solution (known with an uncertainty of +/- 0.00005 g/ml) and the measured density is greater than 0.00008 g/ml then the calibration of the device must be checked.

5.5. Procedure

The operator must ensure that the temperature of the measuring cell is stable. The wine in the densimeter cell must not contain bubbles of gas and must be homogeneous. If an internal light can be used to check for the absence of bubbles, extinguish it quickly after performing the check since the heat generated by the lamp has an impact on the measured temperature.

If the equipment only gives the frequency, the density is calculated using the constants A and B (refer to the instructions for the equipment).

5.6 Precision parameters for the density measuring method using an oscillating cell

n	3800
min	0.99187
max	1.01233
r	0.00011
r%	0.011
s_r	0.000038
R	0.00025

s_R	0.000091
R%	0.025

Key:
n: number of values selected
min: lower limit of range of measurement
max: upper limit of range of measurement
r: repeatability
s_r: Repeatability standard deviation
r%: Relative repeatability (s_r x 100 / mean value)
R: reproducibility
s_R: Reproducibility standard deviation
R%: Relative reproducibility (s_R x 100 / mean value)

6. Density at 20°C and specific gravity at 20°C measured using the hydrostatic balance

6.1 Principle

The density of wine may be measured by densimetry with a hydrostatic balance which relies on the phenomenon defined by Archimedes' principle, namely that any object immersed in a fluid experiences an upwards force equal to the weight of the fluid displaced by the object.

6.2 Equipment and materials

Standard laboratory equipment, including:

6.2.1 Single-pan hydrostatic balance with a precision of 1 mg.

6.2.2 *Float with a volume of at least 20 ml*, specific to the balance, suspended by a thread with a diameter less than or equal to 0.1 mm.

6.2.3 *Measuring cylinder* with a level mark. The float must be capable of being completely contained in the volume below the mark; the surface of the liquid must be penetrated only by the supporting thread. The internal diameter of the measuring cylinder must be at least 6 mm more than that of the float.

6.2.4 *Thermometer* (or temperature probe) with degree and tenth of a degree graduations, from 10 to 40°C, calibrated to ± 0.06°C.

6.2.5 *Weights* calibrated by a recognised certification body.

6.3 Reagents

Unless otherwise indicated, only use analytical quality reagents during the analysis with at least class 3 water corresponding to the definition given in standard ISO 3696:1987.

6.3.1 Washing solution for the float (sodium hydroxide, 30% m/v).
To prepare 100 ml of solution, dissolve 30 g of sodium hydroxide in ethanol 96% vol.

6.4 Procedure

After each measurement, the float and the cylinder must be cleaned with distilled water, wiped with soft laboratory paper which does not shed its fibres and rinsed with the solution whose density is to be determined. The measurements must be performed when the equipment is stable so as to minimise alcohol loss through evaporation.

6.4.1 Balance calibration
Although balances usually have an internal calibration system, the hydrostatic balance must be calibrated with weights that are checked by an official certification body.

6.4.2 Float calibration
Fill the cylinder up to the mark with double-distilled water (or with water of equivalent purity, e.g. microfiltered water with a conductivity of 18.2 MΩ.cm), whose temperature must be between 15 and 25°C, and ideally at 20°C.

Immerse the float and the thermometer in the liquid, stir, read the density of the liquid indicated by the equipment, and, if necessary, adjust this reading such that it is equal to that of the water at the temperature at which the reading was taken.

6.4.3.Verification using a solution of known density

Fill the cylinder up to the mark with a solution of known density, whose temperature is between 15 and 25°C, and ideally at 20°C.

Immerse the float and the thermometer in the liquid, stir, read the density of the liquid indicated by the equipment and record the density and the temperature if the density is measured at t°C (ρ t)

6.4.4 If necessary, correct ρ using the table of densities ρ t for water-alcohol mixtures [Table II of Annex II of the OIV's Compendium of international analysis methods].
The density determined in this way must be identical to the previously determined density.

Note: This solution of known density can be used instead of double-distilled water for the calibration of the float.

6.4.5 Measuring the density of a wine
Pour the sample under test into the cylinder up to the mark.

Immerse the float and the thermometer in the liquid, stir, read the density of the liquid indicated by the apparatus. Record the temperature if the density is measured at t°C (ρ t).

Correct ρ using the table of densities ρ t for water-alcohol mixtures [Table II of Annex II of the OIV's Compendium of international analysis methods].

6.4.6 Cleaning the float and the cylinder.
Immerse the float in the washing solution poured into *the cylinder*.
Leave to soak for one hour, rotating the float frequently.
Rinse thoroughly with tap water, then with distilled water.
Wipe with soft laboratory paper that does not shed fibres.

Perform these operations when the float is used for the first time, and then regularly as required.

6.5 Precision parameters for measuring the density using the hydrostatic balance

n	4347
min	0.99189
max	1.01229
r	0.00025
s_r	0.000090
r%	0.025
R	0.00067
s_R	0.00024
R%	0.067

Key:
n: *number of values selected*
min: *lower limit of range of measurement*
max: upper limit of range of measurement
r: *repeatability*
s_r: *Repeatability standard deviation*
r%: *Relative repeatability (*s_r *x 100 /mean value)*
R: reproducibility
s_R: *Reproducibility standard deviation*
R%: *Relative reproducibility (*s_R *x 100 /mean value)*

6.6 Comparison of results for the density measuring methods using an oscillating cell or an hydrostatic balance

Using samples with a density between 0.992 and 1.012 g/ml repeatability and reproducibility were measured during an inter-laboratory ring test. The density of different samples as measured using the hydrostatic balance and the electronic densimeter and the repeatability and reproducibility values derived from an extensive multiannual inter-comparison exercise were compared.

6.6.1. Samples

Wines of different density and alcoholic strength prepared each month on an industrial scale, taken from a properly stored stock of bottles and delivered as anonymous products to the laboratories.

6.6.2. Laboratories

Laboratories participating in the monthly ring test organised by the Unione Italiana Vini (Verona, Italy) according to ISO 5725 (UNI 9225) rules and the International Protocol of Proficiency Testing for chemical analysis laboratories established by AOAC, ISO and IUPAC and ISO 43 and ILAC G13 guidelines. An annual report is supplied by this organisation to all participants.

6.6.3. Equipment

6.6.3.1. Electronic hydrostatic balance (accurate to 5 decimal places), if possible with a data processing device:

6.6.3.2. Electronic densimeter, if possible with autosampler.

6.6.4. Analysis

According to the rules for the validation of methods, each sample was analysed twice consecutively to determine the alcoholic strength.

6.6.5. Result

Table 1 shows the results of the measurements obtained by the laboratories using the hydrostatic balance.

Table 2 shows the results obtained by the laboratories using an electronic densimeter.

6.6.6. Evaluations of the results

6.6.6.1. The trial results were examined for evidence of individual systematic error ($p < 0{,}025$) using Cochran's and Grubb's tests successively, by procedures described in the internationally agreed Protocol for the Design, Conduct and Interpretation of Method-Performance Studies.

6.6.6.2. *Repeatability (r) and reproducibility (R)*

Calculations for repeatability (r) and reproducibility (R) as defined by that protocol were carried out on those results remaining after the removal of outliers. When assessing a new method there is often no validated reference or statutory method with which to compare precision criteria, hence it is useful to compare the precision data obtained from a collaborative trial with 'predicted' levels of precision. These 'predicted' levels are calculated from the Horwitz equation. Comparison of the trial results and the predicted levels give an indication as to whether the method is sufficiently precise for the level of analyte being measured. The Horwitz predicted value is calculated from the Horwitz equation.

$RSDR = 2^{(1-0,5 \log C)}$

where C = measured concentration of analyte expressed as a decimal (e.g. 1 g/100 g = 0.01).

The Horrat value gives a comparison of the actual precision measured with the precision predicted by the Horwitz equation for a method measuring at that particular level of analyte. It is calculated as follows:

HoR = RSDR(measured)/RSDR(Horwitz)

6.6.6.3. Interlaboratory precision

A Horrat value of 1 usually indicates satisfactory inter-laboratory precision, whereas a value of 2 usually indicates unsatisfactory precision, i.e. one that is too variable for most analytical purposes or where the variation obtained is greater than that expected for the type of method employed. Hor is also calculated, and used to assess intra-laboratory precision, using the following approximation:

RSDr(Horwitz) = 0,66 RSDR(Horwitz) (this assumes the approximation r = 0,66 R).

Table 3 shows the differences between the measurements obtained by laboratories using electronic densimetry and those using a hydrostatic balance.

6.6.6.4. *Precision parameters*

Table 4 shows the average overall precision parameters computed from all monthly trials carried out from January 2008 until December 2010.

Sample	Mean	Total values	Values selected	Repetability	s_r	RSDr	Hor	Reproduci bility	s_R	RSDRcalc	HoR	nº repli es	CrD95
01/08	0,995491	130	120	0,0001701	0,0000607	0,0061016	0,0046193	0,0005979	0,0002135	0,0214502	0,0107178	2	0,0004141
02/08	1,011475	146	125	0,0004714	0,0001684	0,0166457	0,0126320	0,0008705	0,0003109	0,0307366	0,0153947	2	0,0005686
03/08	0,992473	174	161	0,0001470	0,0000525	0,0052898	0,0040029	0,0004311	0,0001540	0,0155140	0,0077482	2	0,0002959
04/08	0,993147	172	155	0,0002761	0,0000986	0,0099274	0,0075130	0,0005446	0,0001945	0,0195839	0,0097818	2	0,0003595
05/08	1,004836	150	138	0,0001882	0,0000672	0,0066905	0,0050723	0,0007495	0,0002677	0,0266373	0,0133283	2	0,0005215
06/08	0,993992	152	136	0,0001486	0,0000531	0,0053391	0,0040411	0,0005302	0,0001894	0,0190506	0,0095167	2	0,0003675
07/08	0,992447	162	150	0,0002660	0,0000950	0,0095709	0,0072424	0,0006046	0,0002159	0,0217575	0,0108664	2	0,0004063
08/08	0,992210	162	151	0,0002619	0,0000935	0,0094281	0,0071341	0,0006309	0,0002253	0,0227108	0,0113420	2	0,0004265
09/08	1,002600	148	131	0,0001093	0,0000390	0,0038920	0,0029496	0,0007000	0,0002500	0,0249341	0,0124719	2	0,0004919
10/08	0,994482	174	152	0,0001228	0,0000439	0,0044105	0,0033385	0,0004250	0,0001518	0,0152645	0,0076259	2	0,0002942
11/08	0,992010	136	125	0,0000909	0,0000325	0,0032742	0,0024775	0,0004256	0,0001520	0,0153217	0,0076516	2	0,0002975
01/09	0,994184	174	152	0,0001655	0,0000591	0,0059435	0,0044987	0,0005439	0,0001942	0,0195384	0,0097606	2	0,0003756
02/09	0,992266	118	101	0,0001742	0,0000622	0,0062682	0,0047431	0,0005210	0,0001861	0,0187534	0,0093658	2	0,0003580
03/09	0,991886	164	135	0,0001850	0,0000661	0,0066603	0,0050395	0,0004781	0,0001707	0,0172136	0,0085963	2	0,0003251
04/09	0,993632	180	150	0,0001523	0,0000544	0,0054754	0,0041440	0,0004270	0,0001525	0,0153476	0,0076664	2	0,0002922
05/09	1,011061	116	100	0,0003659	0,0001307	0,0129234	0,0098067	0,0008338	0,0002978	0,0294527	0,0147508	2	0,0005605
06/09	0,992063	114	105	0,0002923	0,0001044	0,0105238	0,0079631	0,0005257	0,0001877	0,0189240	0,0094507	2	0,0003418
07/09	0,992708	172	155	0,0002892	0,0001033	0,0104040	0,0078732	0,0006156	0,0002199	0,0221478	0,0110617	2	0,0004106
08/09	0,993064	136	127	0,0002926	0,0001045	0,0105224	0,0079632	0,0007520	0,0002686	0,0270446	0,0135081	2	0,0005112
09/09	1,005285	118	110	0,0002946	0,0001052	0,0104661	0,0079352	0,0007226	0,0002581	0,0256704	0,0128454	2	0,0004892
10/09	0,992905	150	132	0,0002234	0,0000798	0,0080358	0,0060812	0,0004498	0,0001607	0,0161803	0,0080815	2	0,0002978
11/09	0,994016	142	127	0,0001896	0,0000677	0,0068114	0,0051555	0,0004739	0,0001693	0,0170278	0,0085062	2	0,0003214
01/10	0,994734	170	152	0,0002125	0,0000759	0,0076288	0,0057748	0,0005406	0,0001931	0,0194104	0,0096975	2	0,0003672
02/10	0,993177	120	110	0,0002210	0,0000789	0,0079467	0,0060140	0,0005800	0,0002071	0,0208565	0,0104175	2	0,0003950
03/10	0,992799	148	136	0,0002277	0,0000813	0,0081923	0,0061995	0,0015157	0,0005413	0,0545262	0,0272335	2	0,0010657
04/10	0,995420	172	157	0,0002644	0,0000944	0,0094866	0,0071819	0,0006286	0,0002245	0,0225542	0,0112693	2	0,0004244
05/10	1,002963	120	108	0,0007086	0,0002531	0,0252330	0,0191244	0,0013667	0,0004881	0,0486677	0,0243447	2	0,0008991
06/10	0,992546	120	113	0,0001737	0,0000620	0,0062506	0,0047300	0,0005435	0,0001941	0,0195567	0,0097673	2	0,0003744
07/10	0,992831	174	152	0,0003003	0,0001073	0,0108031	0,0081753	0,0006976	0,0002492	0,0250959	0,0125344	2	0,0004699
08/10	0,993184	144	130	0,0001799	0,0000642	0,0064674	0,0048945	0,0005951	0,0002125	0,0213984	0,0106882	2	0,0004111
09/10	1,012293	114	103	0,0002265	0,0000809	0,0079907	0,0060647	0,0014586	0,0005209	0,0514596	0,0257772	2	0,0010251
10/10	0,992289	154	136	0,0006386	0,0002281	0,0229860	0,0173933	0,0007033	0,0002512	0,0253124	0,0126415	2	0,0003812
11/10	0,994649	130	112	0,0002902	0,0001036	0,0104200	0,0078876	0,0005287	0,0001888	0,0189830	0,0094838	2	0,0003445

Table 1: Hydrostatic balance (HB)

Table 2: Electronic densimetry (ED)

Sample	Mean	Total values	Values selected	Repetability	s_r	RSDr	Hor	Reproducibility	s_R	RSDRcalc	HoR	nº replies	CrD95
01/08	0,995504	114	108	0,0000755	0,0000270	0,0027085	0,0020505	0,0001571	0,0000561	0,0056361	0,0028162	2	0,0001045
02/08	1,011493	132	125	0,0001921	0,0000686	0,0067837	0,0051480	0,0004435	0,0001584	0,0156582	0,0078426	2	0,0002985
03/08	0,992491	138	118	0,0000746	0,0000266	0,0026830	0,0020303	0,0002745	0,0000980	0,0098776	0,0049332	2	0,0001905
04/08	0,993129	132	120	0,0001230	0,0000439	0,0044247	0,0033486	0,0002863	0,0001023	0,0102965	0,0051429	2	0,0001929
05/08	1,004892	136	116	0,0000926	0,0000331	0,0032893	0,0024937	0,0004777	0,0001706	0,0169785	0,0084955	2	0,0003346
06/08	0,994063	142	123	0,0000558	0,0000199	0,0020051	0,0015177	0,0001776	0,0000634	0,0063791	0,0031867	2	0,0001224
07/08	0,992498	136	125	0,0000822	0,0000294	0,0029576	0,0022381	0,0002094	0,0000748	0,0075368	0,0037641	2	0,0001423
08/08	0,992270	130	115	0,0000515	0,0000184	0,0018537	0,0014027	0,0001665	0,0000595	0,0059940	0,0029935	2	0,0001149
09/08	1,002603	136	121	0,0000821	0,0000293	0,0029236	0,0022157	0,0003328	0,0001189	0,0118565	0,0059306	2	0,0002318
10/08	**0,994493**	**128**	**117**	**0,0000667**	**0,0000238**	**0,0023954**	**0,0018132**	**0,0001429**	**0,0000510**	**0,0051309**	**0,0025633**	**2**	**0,0000954**
11/08	0,992017	118	104	0,0000842	0,0000301	0,0030309	0,0022933	0,0001962	0,0000701	0,0070644	0,0035279	2	0,0001322
01/09	0,994216	148	131	0,0000830	0,0000297	0,0029832	0,0022580	0,0001551	0,0000554	0,0055712	0,0027832	2	0,0001015
02/09	0,992251	104	88	0,0000947	0,0000338	0,0034097	0,0025801	0,0002846	0,0001017	0,0102451	0,0051165	2	0,0001956
03/09	0,991875	126	108	0,0001271	0,0000454	0,0045777	0,0034637	0,0002067	0,0000738	0,0074421	0,0037165	2	0,0001316
04/09	0,993654	134	114	0,0001166	0,0000416	0,0041899	0,0031711	0,0002043	0,0000730	0,0073417	0,0036673	2	0,0001322
05/09	1,011035	128	104	0,0002388	0,0000853	0,0084361	0,0064016	0,0003554	0,0001269	0,0125542	0,0062875	2	0,0002211
06/09	0,992104	116	106	0,0001005	0,0000359	0,0036178	0,0027375	0,0003169	0,0001132	0,0114088	0,0056976	2	0,0002184
07/09	0,992720	144	140	0,0001579	0,0000564	0,0056815	0,0042995	0,0002916	0,0001042	0,0104923	0,0052404	2	0,0001905
08/09	0,993139	110	102	0,0001175	0,0000420	0,0042242	0,0031969	0,0003603	0,0001287	0,0129577	0,0064721	2	0,0002479
09/09	1,005276	112	108	0,0001100	0,0000393	0,0039070	0,0029622	0,0003522	0,0001258	0,0125134	0,0062617	2	0,0002429
10/09	0,992912	122	111	0,0000705	0,0000252	0,0025365	0,0019195	0,0002122	0,0000758	0,0076315	0,0038117	2	0,0001458
11/09	0,994031	128	118	0,0000718	0,0000256	0,0025784	0,0019516	0,0001639	0,0000585	0,0058883	0,0029415	2	0,0001102
01/10	0,994752	144	136	0,0000773	0,0000276	0,0027765	0,0021017	0,0001787	0,0000638	0,0064144	0,0032046	2	0,0001203
02/10	0,993181	108	98	0,0001471	0,0000525	0,0052893	0,0040029	0,0001693	0,0000605	0,0060884	0,0030410	2	0,0000945
03/10	0,992665	140	127	0,0001714	0,0000612	0,0061683	0,0046678	0,0002378	0,0000849	0,0085559	0,0042732	2	0,0001447
04/10	0,995502	142	128	0,0001175	0,0000419	0,0042138	0,0031901	0,0002320	0,0000829	0,0083248	0,0041596	2	0,0001532
05/10	1,002851	130	119	0,0001195	0,0000427	0,0042555	0,0032253	0,0002971	0,0001061	0,0105815	0,0052930	2	0,0002014
06/10	0,992607	106	99	0,0001228	0,0000438	0,0044172	0,0033427	0,0002226	0,0000795	0,0080092	0,0040001	2	0,0001449
07/10	0,992871	160	150	0,0001438	0,0000513	0,0051712	0,0039134	0,0003732	0,0001333	0,0134258	0,0067057	2	0,0002539
08/10	0,993235	104	93	0,0000895	0,0000320	0,0032182	0,0024356	0,0002458	0,0000878	0,0088399	0,0044154	2	0,0001680
09/10	1,012328	112	105	0,0000870	0,0000311	0,0030692	0,0023295	0,0003395	0,0001213	0,0119781	0,0060001	2	0,0002361
10/10	0,992308	128	115	0,0000606	0,0000216	0,0021811	0,0016504	0,0001635	0,0000584	0,0058845	0,0029388	2	0,0001116
11/10	0,994683	120	108	0,0001127	0,0000402	0,0040450	0,0030620	0,0001597	0,0000570	0,0057339	0,0028647	2	0,0000979

Table 3: Comparison of results between hydrostatic balance (HB) and electronic densimetry (DE)

Density - Hydrostatic balance				**Density - Oscillating cell**				**Comparision**
Sample	Mean value	Total values	Selected values	Échantillon	Mean value	Total values	Selected values	Δ(Bi-DE)
01/08	0,995491	130	120	01/08	0,995504	114	108	-0,000013
02/08	1,011475	146	125	02/08	1,011493	132	125	-0,000018
03/08	0,992473	174	161	03/08	0,992491	138	118	-0,000018
04/08	0,993147	172	155	04/08	0,993129	132	120	0,000018
05/08	1,004836	150	138	05/08	1,004892	136	116	-0,000056
06/08	0,993992	152	136	06/08	0,994063	142	123	-0,000071
07/08	0,992447	162	150	07/08	0,992498	136	125	-0,000051
08/08	0,992210	162	151	08/08	0,992270	130	115	-0,000060
09/08	1,002600	148	131	09/08	1,002603	136	121	-0,000003
10/08	0,994482	174	152	10/08	0,994493	128	117	-0,000011
11/08	0,992010	136	125	11/08	0,992017	118	104	-0,000007
01/09	0,994184	174	152	01/09	0,994216	148	131	-0,000031
02/09	0,992266	118	101	02/09	0,992251	104	88	0,000015
03/09	0,991886	164	135	03/09	0,991875	126	108	0,000011
04/09	0,993632	180	150	04/09	0,993654	134	114	-0,000022
05/09	1,011061	116	100	05/09	1,011035	128	104	0,000026
06/09	0,992063	114	105	06/09	0,992104	116	106	-0,000041
07/09	0,992708	172	155	07/09	0,992720	144	140	-0,000012
08/09	0,993064	136	127	08/09	0,993139	110	102	-0,000075
09/09	1,005285	118	110	09/09	1,005276	112	108	0,000009
10/09	0,992905	150	132	10/09	0,992912	122	111	-0,000008
11/09	0,994016	142	127	11/09	0,994031	128	118	-0,000015
01/10	0,994734	170	152	01/10	0,994752	144	136	-0,000018
02/10	0,993177	120	110	02/10	0,993181	108	98	-0,000005
03/10	0,992799	148	136	03/10	0,992665	140	127	0,000134
04/10	0,995420	172	157	04/10	0,995502	142	128	-0,000082
05/10	1,002963	120	108	05/10	1,002851	130	119	0,000112
06/10	0,992546	120	113	06/10	0,992607	106	99	-0,000061
07/10	0,992831	174	152	07/10	0,992871	160	150	-0,000040
08/10	0,993184	144	130	08/10	0,993235	104	93	-0,000052
09/10	1,012293	114	103	09/10	1,012328	112	105	-0,000035
10/10	0,992289	154	136	10/10	0,992308	128	115	-0,000019
11/10	0,994649	130	112	11/10	0,994683	120	108	-0,000035
						average	Δ(Bi-DE)	-0,0000162
						Std. dev.	Δ(Bi-DE)	0,0000447

Table 4: Precision parameters

	hydrostatic balance (HB)	*electronic densimetry (DE)*
n° selected values	4347	3800
min	0,99189	0,99187
max	1,01229	1,01233
R	0,00067	0,00025
s_R	0,00024	0,000091
R%	0,067	0,025
r	0,00025	0,00011
s_r	0,000090	0,000038
r%	0,025	0,011

ANNEX I

(worked example)

I. Pycnometry with twin-pan balance

A/ Standardization of the pycnometer

1. Weigh a clean and dry pycnometer:

   Tare = pycnometer + p
   p= 104.9454 g

2. Weigh pycnometer filled with water at temperature t°C:

   Tare = pycnometer + water + p'
   p' = 1.2396 g at t = 20.5°C

3. Calculate mass of air within the pycnometer:

   $m = 0.0012\,(p - p')$
   $m = 0.0012\,(104.9454 - 1.2396)$
   $m = 0.1244$

4. Values to record:

   Tare of empty pycnometer: $p + m$
   $p + m = 104.9454 + 0.1244$
   $p + m = 105.0698$ g

   Volume at 20°C = $(p + m - p') \times F_{t°C}$
   $F_{20.50°C}$ = 1.001900
   $V_{20°C}$ = (105.0698 - 1.2396) x 1.001900
   $V_{20°C}$ = 104.0275 mL

   Mass of water at 20°C = $V_{20°C}$ x 0.998203
   $M_{20°C}$ = 103.8405 g

B/. Determination of density at 20°C and 20°C/20°C density for dry wine:

p'' = 1.2622 at 17.80°C

$$\rho_{17.80°C} = \frac{105.0698 - 1.2622}{104.0275}$$

$$\rho_{17.80°C} = 0.99788$$

$p_{20°C}$ can be calculated from $\rho_{t°C}$ using Table II and the equation:

$$\rho_{20°C} = \rho_{t°C} \pm \frac{c}{1000}$$

At t = 17.80°C and for an alcoholic strength of 11% vol., c = 0.54:

$$\rho_{20°C} = 0.99788 \pm \frac{0.54}{1000}$$

$$\rho_{20°C} = 0.99734\ \mathrm{g/mL}$$

$$d_{20°C}^{20°C} = \frac{0.99734}{0.998203} + 0.99913$$

II. Pycnometry with single-pan balance

A/ Standardization of the pycnometer

1. Mass of clean and dry pycnometer:
   P = 67.7913 g
2. Mass pycnometer filled with water at temperature *t*°C:
   P_1 = 169.2715g at 21.65°C
3. Calculate mass of air within the pycnometer:
   m = 0.0012 (P_1 - P)
   m = 0.0012 x 101.4802
   m = 0.1218g
4. Values to record:
   Tare of empty pycnometer: P - *m*
   P - *m* = 67.7913 - 0.1218
   P - *m* = 67.6695 g
   Volume at 20°C = [P_1 - (P - *m*)] x $F_{t°C}$
   $F_{21.65°C}$ = 1.002140
   $V_{20°C}$ = (169.2715 - 67.6695) x 1.002140
   $V_{20°C}$ = 101.8194 mL

Mass of water at 20°C = $V_{20°C}$ x 0.998203
$M_{20°C}$ = 101.6364 g
Mass of tare flask: T_0
T_0 = 171.9160 g

B/ *Determination of density at 20°C and 20°C/20°C specific gravity for a dry wine:*

T_1 = 171.9178
*d*T = 171.9178 - 171.9160 = +0.0018 g
P - *m* + *d*T = 67.6695 + 0.0018 = 67.6713 g
P_2 = 169.2799 at 18°C

$$\rho_{18°C} = \frac{169.2799 - 67.6713}{101.8194}$$

$$\rho_{18°C} = 0.99793 \text{ g/mL}$$

$\rho_{20°C}$ can be calculated from $\rho_{t°C}$ using Table II and the equation:

$$\rho_{20°C} = \rho_{t°C} \pm \frac{c}{1000}$$

For *t* = 18°C and an alcoholic strength of 11% vol., *c* = 0.49:

$$\rho_{20°C} = 0.99793 - \frac{0.49}{1000}$$

$$\rho_{20°C} = 0.99744 \text{ g/mL}$$

$$d_{20^\circ C}^{20^\circ C} = \frac{0.99744}{0.998203} = 0.99923$$

ANNEX II
Tables

TABLE I

F Factors
by which the mass of the water in the *Pyrex pycnometer* at *t*°C has to be multiplied to calculate the volume of the pycnometer at 20°C.

t °C	F	*t* °C	F	*t* °C	F	*t* °C	F	*t* °C	F	*t* °C	F	*t* °C	F
10.0	1.000398	13.0	1.000691	16.0	1.001097	19.0	1.001608	22.0	1.002215	25.0	1.002916	28.0	1.003704
.1	1.000406	.1	1.000703	.1	1.001113	.1	1.001627	.1	1.002238	.1	1.002941	.1	1.003731
.2	1.000414	.2	1.000714	.2	1.001128	.2	1.001646	.2	1.002260	.2	1.002966	.2	1.003759
.3	1.000422	.3	1.000726	.3	1.001144	.3	1.001665	.3	1.002282	.3	1.002990	.3	1.003797
.4	1.000430	.4	1.000738	.4	1.001159	.4	1.001684	.4	1.002304	.4	1.003015	.4	1.003815
10.5	1.000439	13.5	1.000752	16.5	1.001175	19.5	1.001703	22.5	1.002326	25.5	1.003041	28.5	1.003843
.6	1.000447	.6	1.000764	.6	1.001191	.6	1.001722	.6	1.002349	.6	1.003066	.6	1.003871
.7	1.000456	.7	1.000777	.7	1.001207	.7	1.001741	.7	1.002372	3	1.003092	.7	1.003899
.8	1.000465	.8	1.000789	.8	1.001223	.8	1.001761	.8	1.002394	.8	1.003117	.8	1.003928
.9	1.000474	.9	1.000803	.9	1.001239	9	1.001780	.9	1.002417	.9	1.003143	.9	1.003956
11.0	1.000483	14.0	1.000816	17.0	1.001257	20.0	1.001800	23.0	1.002439	26.0	1.003168	29.0	1.003984
.1	1.000492	.1	1.000829	.1	1.001273	.1	1.001819	.1	1.002462	.1	1.003194	.1	1.004013
.2	1.000501	.2	1.000842	.2	1.001286	.2	1.001839	.2	1.002485	1	1.003222	2	1.004042
3	1.000511	3	1.000855	3	1.001306	.3	1.001959	.3	1.002508	.3	1.003247	.3	1.004071
.4	1.000520	.4	1.000868	.4	1.001323	.4	1.001880	.4	1.002531	.4	1.003273	.4	1.004099
11.5	1.000530	14.5	1.000882	17.5	1.001340	20.5	1.001900	23.5	1.002555	26.5	1.003299	29.5	1.004128
.6	1.000540	.6	1.000895	.6	1.001357	.6	1.001920	.6	1.002578	.6	1.003326	.6	1.004158
.7	1.000550	.7	1.000909	.7	1.001374	.7	1.001941	3	1.002602	.7	1.003352	.7	1.004187
.8	1.000560	.8	1.000923	.8	1.001391	.8	1.001961	.8	1.002625	.8	1.003379	. 8	1.004216
.9	1.000570	.9	1.000937	.9	1.001409	.9	1.001982	.9	1.002649	.9	1.003405	.9	1.004245
12.0	1.000580	15.0	1.000951	18.0	1.001427	21.0	1.002002	24.0	1.002672	27.0	1.003432	30.0	1.004275
.1	1.000591	.1	1.000965	.1	1.001445	.1	1.002023	.1	1.002696	.1	1.003459		
.2	1.000601	.2	1.000979	.2	1.001462	.2	1.002044	.2	1.002720	.2	1.003485		
.3	1.000612	.3	1.000993	.3	1.001480	.3	1.002065	.3	1.002745	.3	1.003513		
.4	1.000623	.4	1.001008	.4	1.001498	.4	1.002086	.4	1.002769	.4	1.003540		
12.5	1.000634	15.5	1.001022	18.5	1.001516	21.5	1.002107	24.5	1.002793	27.5	1.003567		
.6	1.000645	.6	1.001037	.6	1.001534	.6	1.002129	.6	1.002817	.6	1.003594		
.7	1.000656	.7	1.0010 52	.7	1.001552	.7	1.002151	.7	1.002842	.7	1.003621		
.8	1.000668	.8	1.001067	.8	1.001570	.8	1.002172	.8	1.002866	.8	1.003649		
.9	1.000679	.9	1.001082	.9	1.001589	.9	1.002194	.9	1.002891	.9	1.003676		

Table II

Temperature corrections *c*, required for the density of dry wines and dry alcohol free wines, measured in a *Pyrex-glass* pycnometer at *t*°C, in order to correct to 20°C

$$\rho_{20} = \rho_t \pm \frac{c}{1000} \quad \begin{matrix} - \text{ si } t^o \text{ est inférieure à 20 °C} \\ + \text{ si } t^o \text{ est supérieure à 20 °C} \end{matrix}$$

Temperatures in °C	Alcoholic strength																							
	0	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
10°	1,59	1,64	1,67	1,71	1,77	1,84	1,91	2,01	2,11	2,22	2,34	2,46	2,60	2,73	2,88	3,03	3,19	3,35	3,52	3,70	3,87	4,06	4,25	4,44
11°	1,48	1,53	1,56	1,60	1,64	1,70	1,77	1,86	1,95	2,05	2,16	2,27	2,38	2,51	2,63	2,77	2,91	3,06	3,21	3,36	3,53	3,69	3,86	4,03
12°	1,36	1,40	1,43	1,46	1,50	1,56	1,62	1,69	1,78	1,86	1,96	2,05	2,16	2,27	2,38	2,50	2,62	2,75	2,88	3,02	3,16	3,31	3,46	3,61
13°	1,22	1,26	1,28	1,32	1,35	1,40	1,45	1,52	1,59	1,67	1,75	1,83	1,92	2,01	2,11	2,22	2,32	2,44	2,55	2,67	2,79	2,92	3,05	3,18
14°	1,08	1,11	1,13	1,16	1,19	1,23	1,27	1,33	1,39	1,46	1,52	1,60	1,67	1,75	1,94	1,93	2,03	2,11	2,21	2,31	2,42	2,52	2,63	2,74,
15°	0,92	0,96	0,97	0,99	1,02	1,05	1,09	1,13	1,19	1,24	1,30	1,36	1,42	1,48	1,55	1,63	1,70	1,78	1,86	1,95	2,03	2,12	2,21	2,30
16°	0,76	0,79	0,80	0,81	0,94	0,86	0,89	0,93	0,97	1,01	1,06	1,10	1,16	1,21	1,26	1,32	1,38	1,44	1,51	1,57	1,64	1,71	1,78	1,85
17°	0,59	0,61	0,62	0,63	0,65	0,67	0,69	0,72	0,75	0,78	0,81	0,85	0,88	0,95	0,96	1,01	1,05	1,11	1,15	1,20	1,25	1,30	1,35	1,40
18°	0,40	0,42	0,42	0,43	0,44	0,46	0,47	0,49	0,51	0,53	0,55	0,57	0,60	0,63	0,65	0,68	0,71	0,74	0,77	0,81	0,84	0,87	0,91	0,94
19°	0,21	0,21	0,22	0,22	0,23	0,23	0,24	0,25	0,26	0,27	0,28	0,29	0,30	0,32	0,33	0,34	0,36	0,37	0,39	0,41	0,42	0,44	0,46	0,47
20°																								
21°	0,21	0,22	0,22	0,23	0,23	0,24	0,25	0,26	0,27	0,28	0,29	0,30	0,31	0,32	0,34	0,36	0,37	0,38	0,40	0,41	0,43	0,44	0,46	0,48
22°	0,44	0,45	0,46	0,47	0,48	0,49	0,51	0,52	0,54	0,56	0,59	0,61	0,63	0,66	0,69	0,71	0,74	0,77	0,80	0,83	0,87	0,90	0,93	0,97
23°	0,68	0,70	0,71	0,72	0,74	0,76	0,78	0,80	0,83	0,86	0,90	0,93	0,96	1,00	1,03	1,08	1,13	1,17	1,22	1,26	1,31	1,37	1,41	1,46
24°	0,93	0,96	0,97	0,99	1,01	1,03	1,06	1,10	1,13	1,18	1,22	1,26	1,31	1,36	1,41	1,47	1,52	1,58	1,64	1,71	1,77	1,84	1,90	1,97
25°	1,19	1,23	1,25	1,27	1,29	1,32	1,36	1,40	1,45	1,50	1,55	1,61	1,67	1,73	1,80	1,86	1,93	2,00	2,08	2,16	2,24	2,32	2,40	2,48
26°	1,47	1,51	1,53	1,56	1,59	1,62	1,67	1,72	1,77	1,83	1,90	1,96	2,03	2,11	2,19	2,27	2,35	2,44	2,53	2,62	2,72	2,81	2,91	3,01
27°	1,75	1,80	1,82	1,85	1,89	1,93	1,98	2,04	2,11	2,18	2,25	2,33	2,41	2,50	2,59	2,68	2,78	2,88	2,98	3,09	3,20	3,31	3,42	3,33
28°	2,04	2,10	2,13	2,16	2,20	2,25	2,31	2,38	2,45	2,53	2,62	2,70	2,80	2,89	3,00	3,10	3,21	3,32	3,45	3,57	3,69	3,82	3,94	4,07
29°	2,34	2,41	2,44	2,48	2,53	2,58	2,65	2,72	2,81	2,89	2,99	3,09	3,19	3,30	3,42	3,53	3,65	3,78	3,92	4,05	4,19	4,33	4,47	4,61
30°	2,66	2,73	2,77	2,81	2,86	2,92	3,00	3,08	3,17	3,27	3,37	3,48	3,59	3,72	3,84	3,97	4,11	4,25	4,40	4,55	4,70	4,85	4,92	5,17

Note: This table can be used to convert d_{20}^{t} to d_{20}^{20}

Table III

Temperature corrections *c* required for the density of natural or concentrated musts as measured in a *Pyrex-glass* pycnometer at *t* °C to correct to 20°C.

$$\rho_{20} = \rho_t \pm \frac{c}{1000} \quad \begin{matrix} - \text{ if } t^o \text{ is less than } 20\,^oC \\ + \text{ if } t^o \text{ is more than } 20^oC \end{matrix}$$

Temperatures in °C	Density																					
	1,05	1,0	1,0	1,0	1,0	1,1	1,1	1,1	1,1	1,1	1,1	1,1	1,18	1,2	1,2	1,2	1,2	1,2	1,3	1,3	1,3	1,3
10°	2,31	2,48	2,66	2,82	2,99	3,13	3,30	3,44	3,59	3,73	3,88	4,01	4,28	4,52	4,76	4,98	5,18	5,42	5,56	5,73	5,90	6,05
11°	2,12	2,28	2,42	2,57	2,72	2,86	2,99	3,12	3,25	3,37	3,50	3,62	3,85	4,08	4,29	4148	4,67	4,84	5,00	5,16	5,31	5,45
12°	1,92	2,06	2,19	2,32	2,45	2,58	2,70	2,92	2,94	3,04	3,15	3,26	3,47	3,67	3,85	4,03	4,20	4,36	4,51	4,65	478	4,91
13°	1,72	1,84	1,95	2,06	2,17	2,27	2,38	2,48	2,58	2,69	2,78	2,89	3,05	3,22	3,39	3,55	3,65	3,84	3,98	4,11	4:24	4,36
14°	1,52	1,62	1,72	1,81	1,90	2,00	2,09	2,17	2,26	2,34	2,43	2,51	2,66	2,82	2,96	3,09	3,22	3,34	3,45	3,56	3,67	3,76
15°	1,28	1,36	1,44	1,52	1,60	1,67	1,75	1,82	1,89	1,96	2,04	2,11	2,24	2,36	2,48	2,59	2,69	2,79	2,88	2,97	3,03	3,10
16°	1,05	1,12	1,18	1,25	1,31	1,37	1,43	1,49	1,55	1,60	1,66	1,71	1,81	1,90	2,00	2,08	2,16	2,24	2,30	2,37	2,43	2,49
17°	0,80	0,86	0,90	0,95	1,00	1,04	1,09	1,13	1,18	1,22	1,26	1,30	1,37	1,44	1,51	1,57	1,62	1,68	1,72	1,76	1,80	1,84
18°	0,56	0,59	0,62	0,66	0,68	0,72	0,75	0,77	0,80	0,83	0,85	0,88	0,93	0,98	1,02	1,05	1,09	1,12	1,16	1,19	1,21	1,24
19°	0,29	0,31	0,32	0,34	0,36	0,37	0,39	0,40	0,42	0,43	0,44	0,45	0,48	0,50	0,52	0,54	0,56	0,57	0,59	0,60	0,61	0:62
20°																						
21°	0,29	0,30	0,32	0,34	0,35	0,37	0,38	0,40	0,41	0,42	0,44	0,46	0,48	0,50	0,53	0,56	0,58	0,59	0,60	0,61	0,62	0,62
22°	0,58	0,61	0,64	0,67	0,70	0,73	0,76	0,79	0,81	0,84	0,87	0,90	0,96	1,03	1,05	1,09	1,12	1,15	1,18	1,20	1,22	1,23
23°	0,89	0,94	0,99	1,03	1,08	1,12	1,16	1,20	1,25	1,29	1,33	1,37	1,44	1,51	1,57	1,63	1,67	1,73	1,77	1,80	1,82	1,94
24°	1,20	1,25	1,31	1,37	1,43	1,49	1,54	1,60	1,66	1,71	1,77	1,82	1,92	2,01	2,10	2,17	2,24	2,30	2,36	2,40	2,42	2,44
25°	1,51	1,59	1,66	1,74	1,81	1,88	1,95	2,02	2,09	2,16	2,23	2,30	2,42	2,53	2,63	2,72	2,82	2,89	2,95	2,99	3,01	3,05
26°	1,84	1,92	2,01	2,10	2,18	2,26	2,34	2,42	2,50	2,58	2,65	2,73	2,87	3,00	3,13	3,25	3,36	3,47	3,57	3,65	372	3,79
27°	2,17	2,26	2,36	2,46	2,56	2,66	2,75	2,84	2,93	3,01	3,10	3,18	3,35	3,50	3,66	3,80	3,93	4,06	4,16	4,26	4:35	4,42
28°	2,50	2,62	2,74	2,85	2,96	3,07	3,18	3,28	3,40	3,50	3,60	3,69	3,87	4,04	4,21	4,36	4,50	4,64	4,75	4,86	4,94	5,00
29°	2,86	2,98	3,10	3,22	3,35	3,47	3,59	3,70	3,82	3,93	4,03	4,14	4,34	4,53	4,72	4,89	5,05	5,20	5,34	5,46	5,56	5,64
30°	3,20	3,35	3,49	3,64	3,77	3,91	4,05	4,17	4,30	4,43	4,55	4,67	4,90	5,12	5,39	5,51	5,68	5,94	5,96	6,09	6,16	6,22

Note: This table can be used to convert d_{20}^{t} to d_{20}^{20}

TABLE IV

Temperature corrections *c* required for the density of dessert wines measured in a *Pyrex-glass* pycnometer at *t* ^oC_t to correct to 20 ^oC.

$$\rho_{20} = \rho_t \pm \frac{c}{1000} \quad \begin{array}{l} - \text{ if } t^o \text{ is less than } 20\ ^oC \\ + \text{ if } t^o \text{ is more than } 20\ ^oC \end{array}$$

Temperatures in °C	13% vol. wine							15% vol. wine							17% vol. wine						
	Density							Density							Density						
	1,000	1,020	1,040	1,060	1,080	1,100	1,120	1,000	1,020	1,040	1,060	1,080	1,100	1,120	1,000	1,020	1,040	1,060	1,080	1,100	1,120
10°	2,36	2,71	3,06	3,42	3,72	3,96	4,32	2,64	2,99	3,36	3,68	3,99	4,30	4,59	2,94	3,29	3,64	3,98	4,29	4,60	4,89
11°	2,17	2,49	2,80	2,99	3,39	3,65	3,90	2,42	2,73	3,05	3,34	3,63	3,89	4,15	2,69	3,00	3,32	3,61	3,90	4,16	4,41
12°	1,97	2,25	2,53	2,79	3,05	3,29	3,52	2,19	2,47	2,75	3,01	3,27	3,51	3,73	2,42	2,70	2,98	3,24	3,50	3,74	3,96
13°	1,78	2,02	2,25	2,47	2,69	2,89	3,09	1,97	2,21	2,44	2,66	2,87	3,08	3,29	2,18	2,42	2,64	2,87	3,08	3,29	3,49
14°	1,57	1,78	1,98	2,16	2,35	2,53	2,70	1,74	1,94	2,14	2,32	2,52	2,69	2,86	1,91	2,11	2,31	2,50	2,69	2,86	3,03
15°	1,32	1,49	1,66	1,82	1,97	2,12	2,26	1,46	1,63	1,79	1,95	2,10	2,25	2,39	1,60	1,77	1,93	2,09	2,24	2,39	2,53
16°	1,08	1,22	1,36	1,48	1,61	1,73	1,84	1,18	1,32	1,46	1,59	1,71	1,83	1,94	1,30	1,44	1,58	1,71	1,83	1,95	2,06
17°	0,83	0,94	1,04	1,13	1,22	1,31	1,40	0,91	1,02	1,12	1,21	1,30	1,39	1,48	1,00	1,10	1,20	1,30	1,39	1,48	1,56
18°	0,58	0,64	0,71	0,78	0,84	0,89	0,95	0,63	0,69	0,76	0,83	0,89	0,94	1,00	0,69	0,75	0,82	0,89	0,95	1,00	1,06
19°	0,30	0,34	0,37	0,40	0,43	0,46	0,49	0,33	0,37	0,40	0,43	0,46	0,49	0,52	0,36	0,39	0,42	0,46	0,49	0,52	0,54
20°																					
21°	0,30	0,33	0,36	0,40	0,43	0,46	0,49	0,33	0,36	0,39	0,43	0,46	0,49	0,51	0,35	0,39	0,42	0,45	0,48	0,51	0,54
22°	0,60	0,67	0,73	0,80	0,85	0,91	0,98	0,65	0,72	0,78	0,84	0,90	0,96	1,01	0,71	0,78	0,84	0,90	0,96	1,01	1,07
23°	0,93	1,02	1,12	1,22	1,30	1,39	1,49	1,01	1,10	1,20	1,29	1,38	1,46	1,55	1,10	1,19	1,29	1,38	1,46	1,55	1,63
24°	1,27	1,39	1,50	1,61	1,74	1,84	1,95	1,37	1,49	1,59	1,72	1,84	1,95	2,06	1,48	1,60	1,71	1,83	1,95	2,06	2,17
25°	1,61	1,75	1,90	2,05	2,19	2,33	2,47	1,73	1,87	2,02	2,17	2,31	2,45	2,59	1,87	2,01	2,16	2,31	2,45	2,59	2,73
26°	1,94	2,12	2,29	2,47	2,63	2,79	2,95	2,09	2,27	2,44	2,62	2,78	2,94	3,10	2,26	2,44	2,61	2,79	2,95	3,11	3,26
27°	2,30	2,51	2,70	2,90	3,09	3,27	3,44	2,48	2,68	2,87	3,07	3,27	3,45	3,62	2,67	2,88	3,07	3,27	3,46	3,64	3,81
28°	2,66	2,90	3,13	3,35	3,57	3,86	4,00	2,86	3,10	3,23	3,55	3,77	3,99	4,20	3,08	3,31	3,55	3,76	3,99	4,21	4,41
29°	3,05	3,31	3,56	3,79	4,04	4,27	4,49	3,28	3,53	3,77	4,02	4,26	4,49	4,71	3,52	3,77	4,01	4,26	4,50	4,73	4,95
30°	3,44	3,70	3,99	4,28	4,54	4,80	5,06	3,68	3,94	4,23	4,52	4,79	5,05	5,30	3,95	4,22	4,51	4,79	5,07	5,32	5,57

TABLE IV (continued)
Temperature corrections *c* required for the density of dessert wines measured in a *Pyrex-glass* pycnometer at t °C_t to correct to 20 °C.

$$\rho_{20} = \rho_t \pm \frac{c}{1000}$$

- I f t^o is less than 20 °C
+ if t^o is more than 20 °C

Temperatures in °C		19% vol. wine							21% vol. wine						
		Density							Density						
		1,000	1,020	1,040	1,060	1,000	1,100	1,120	1,000	1,020	1,040	1,060	1,080	1,100	1,120
	10°	3,27	3,62	3,97	4,30	4,62	4,92	5,21	3,62	3,97	4,32	4,66	4,97	5,27	5,56
	11°	2,99	3,30	3,61	3,90	4,19	4,45	4,70	3,28	3,61	3,92	4,22	4,50	4,76	5,01
	12°	2,68	2,96	3,24	3,50	3,76	4,00	4,21	2,96	3,24	3,52	3,78	4,03	4,27	4,49
	13°	2,68	2,96	3,24	3,50	3,76	4,00	4,21	2,96	3,24	3,52	3,78	4,03	4,27	4,49
	14°	2,11	2,31	2,51	2,69	2,88	3,05	3,22	2,31	2,51	2,71	2,89	3,08	3,25	3,43
	15°	1,76	1,93	2,09	2,25	2,40	2,55	2,69	1,93	2,10	2,26	2,42	2,57	2,72	2,86
	16°	1,43	1,57	1,70	1,83	1,95	2,08	2,18	1,56	1,70	1,84	1,97	2,09	2,21	2,32
	17°	1,09	1,20	1,30	1,39	1,48	1,57	1,65	1,20	1,31	1,41	1,50	1,59	1,68	1,77
	18°	0,76	0,82	0,88	0,95	1,01	1,06	1,12	0,82	0,88	0,95	1,01	1,08	1,13	1,18
	19°	0,39	0,42	0,45	0,49	0,52	0,55	0,57	0,42	0,46	0,49	0,52	0,55	0,58	0,61
	20°														
	21°	0,38	0,42	0,45	0,48	0,51	0,54	0,57	0,41	0,45	0,48	0,51	0,54	0,57	0,60
	22°	0,78	0,84	0,90	0,96	1,02	1,07	1,13	0,84	0,90	0,96	1,02	1,08	1,14	1,19
	23°	1,19	1,28	1,38	1,47	1,55	1,64	1,72	1,29	1,39	1,48	1,57	1,65	1,74	1,82
	24°	1,60	1,72	1,83	1,95	2,06	2,18	2,29	1,73	1,85	1,96	2,08	2,19	2,31	2,42
	25°	2,02	2,16	2,31	2,46	2,60	2,74	2,88	2,18	2,32	2,47	2,62	2,76	2,90	3,04
	26°	2,44	2,62	2,79	2,96	3,12	3,28	3,43	2,53	2,81	2,97	3,15	3,31	3,47	3,62
	27°	2,88	3,08	3,27	3,42	3,66	3,84	4,01	3,10	3,30	3,47	3,69	3,88	4,06	4,23
	28°	3,31	3,54	3,78	4,00	4,22	4,44	4,64	3,56	3,79	4,03	4,25	4,47	4,69	4,89
	29°	3,78	4,03	4,27	4,52	4,76	4,99	5,21	4,06	4,31	4,55	4,80	5,04	5,27	5,48
	30°	4,24	4,51	4,80	5,08	5,36	5,61	5,86	4,54	4,82	5,11	5,39	5,66	5,91	6,16

Table V

Temperature corrections *c* for the density of dry wines and dry wines with alcohol removed, measured with an *ordinary- glass* pycnometer or hydrometer at *t* °C, to correct to 20°C.

$$\rho_{20} = \rho_t \pm \frac{c}{1000} \quad \begin{array}{l} - \text{ if } t^o \text{ is less than } 20\ ^oC \\ + \text{ if } t^o \text{ is more than } 20\ ^oC \end{array}$$

Temperatures in °C	Alcoholic strength																							
	0	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
10°	1,45	1,51	1,55	1,58	1,64	1,76	1,78	1,89	1,98	2,09	2,21	2,34	2,47	2,60	2,15	2,93	3,06	3,22	3,39	3,57	3,75	3,93	4,12	4,31
11°	1,35	1,40	1,43	1,47	1,52	1,58	1,65	1,73	183	1,93	2,03	2,15	2,26	2,38	2,51	2,65	2,78	2,93	3,08	3,24	3,40	3,57	3,73	3,90
12°	1,24	1,28	1,31	1,34	1,39	1,44	1,50	1,58	1,66	1,75	1,84	1,94	2,04	2,15	2,26	2,38	2,51	2,63	2,77	2,91	3,05	3,19	3,34	3,49
13°	1,12	1,16	1,18	1,21	1,25	1,30	1,35	1,42	1,49	1,56	1,64	1,73	1,82	1,91	2,01	2,11	2,22	2,33	2,45	2,57	2,69	2,81	2,95	3,07
14°	0,99	1,03	1,05	1,07	1,11	1,14	1,19	1,24	1,31	1,37	1,44	1,52	1,59	1,67	1,75	1,84	1,93	2,03	2,13	2,23	2,33	2,44	2,55	2,66
15°	0,86	0,89	0,90	0,92	0,95	0,98	1,02	1,07	1,12	1,17	1,23	1,29	1,35	1,42	1,49	1,56	1,63	1,71	1,80	1,88	1,96	2,05	2,14	2,23
16°	0,71	0,73	0,74	0,76	0,78	0,81	0,84	0,87	0,91	0,95	0,99	1,05	1,10	1,15	1,21	1,27	1,33	1,39	1,45	1,52	1,59	1,66	1,73	1,80
17°	0,55	0,57	0,57	0,59	0,60	0,62	0,65	0,67	0,70	0,74	0,77	0,81	0,84	0,88	0,92	0,96	1,01	1,05	1,10	1,15	1,20	1,26	1,31	1,36
18°	0,38	0,39	0,39	0,40	0,41	0,43	0,44	0,46	0,48	0,50	0,52	0,55	0,57	0,60	0,62	0,65	0,68	0,71	0,74	0,78	0,81	0,85	0,88	0,91
19°	0,19	0,20	0,20	0,21	0,21	0,22	0,23	0,24	0,25	0,26	0,27	0,28	0,29	0,30	0,32	0,33	0,34	0,36	0,38	0,39	0,41	0,43	0,44	0,46
20°																								
21°	0,21	0,22	0,22	0,23	0,23	0,24	0,25	0,25	0,26	0,27	0,28	0,29	0,31	0,32	0,34	0,35	0,36	0,38	0,39	0,41	0,43	0,44	0,46	0,48
22°	0,43	0,45	0,45	0,46	0,47	0,49	0,50	0,52	0,54	0,56	0,58	0,60	0,62	0,65	0,68	0,71	0,73	0,77	0,80	0,83	0,86	0,89	0,93	0,96
23°	0,67	0,69	0,70	0,71	0,72	0,74	0,77	0,79	0,82	0,85	0,88	0,91	0,95	0,99	1,03	1,07	1,12	1,16	1,21	1,25	1,30	1,35	1,40	1,45
24°	0,91	0,93	0,95	0,97	0,99	1,01	1,04	1,07	1,11	1,15	1,20	1,24	1,29	1,34	1,39	1,45	1,50	1,56	1,62	1,69	1,76	1,82	1,88	1,95
25°	1,16	1,19	1,21	1,23	1,26	1,29	1,33	1,37	1,42	1,47	1,52	1,57	1,63	1,70	1,76	1,83	1,90	1,97	2,05	2,13	2,21	2,29	2,37	2,45
26°	1,42	1,46	1,49	1,51	1,54	1,58	1,62	1,67	1,73	1,79	1,85	1,92	1,99	2,07	2,14	2,22	2,31	2,40	2,49	2,58	2,67	2,77	2,86	2,96
27°	1,69	1,74	1,77	1,80	1,83	1,88	1,93	1,98	2,05	2,12	2,20	2,27	2,35	2,44	2,53	2,63	2 72	2,82	2,93	3,04	3,14	3,25	3,37	3,48
28°	1,97	2,03	2,06	2,09	2,14	2,19	2,24	2,31	2,38	2,46	2,55	2,63	2,73	2,83	2,93	3,03	3,14	3,26	3,38	3,50	3,62	3,75	3,85	4,00
29°	2,26	2,33	2,37	2,41	2,45	2,50	2,57	2,64	2,73	2,82	2,91	2,99	3,11	3,22	3,34	3,46	3,58	3,70	3,84	3,97	4,11	4,25	4,39	4,54
30°	2,56	2,64	2,67	2,72	2,77	2,83	2,90	2,98	3,08	3,18	3,28	3,38	3,50	3,62	3,75	3,88	4,02	4,16	4,30	4,46	4,61	4,76	4,92	5,07

Note: This table can be used to convert d^t_{20} to d^{20}_{20}

Table VI

Temperature corrections c required for the density of natural or concentrated musts, measured with an *ordinary-glass* pycnometer-or hydrometer at t °C, to correct to 20 °C.

$$\rho_{20} = \rho_t \pm \frac{c}{1000}$$

- if t^o is less than 20 °C
+ if t^o is more than 20 °C

	Masses volumiques																					
Température en °C	1,05	1,06	1,07	1,08	1,09	1,10	1,11	1,12	1,13	1,14	1,15	1,16	1,18	1,20	1,22	1,24	1,26	1,28	1,30	1,32	1,34	1,36
10°	2,17	2,34	2,52	2,68	2,85	2,99	3,16	3,29	3,44	3,58	3,73	3,86	4,13	4,36	4,60	4,82	5,02	5,25	5,39	5,56	-5,73	5,87
11°	2, 00	2,16	2,29	2,44	2,59	2,73	2,86	2,99	3,12	3,24	3,37	3,48	3,71	3,94	4,15	4,33	4,52	4,69	4,85	5,01	5,15	5,29
12°	1,81	1,95	2,08	2,21	2,34	2,47	2,58	2,70	2,82	2,92	3,03	3,14	3,35	3,55	3,72	3,90	4,07	4,23	4,37	4,52	4,64	4,77
13°	1,62	1,74	1,85	1,96	2,07	2,17	2,28	2,38	2,48	2,59	2,68	2,77	2,94	3,11	3,28	3,44	3,54	3,72	3,86	3,99	4,12	4,24
14°	1,44	1,54	1,64	1,73	1,82	1,92	2,00	2,08	2,17	2,25	2,34	2,42	2,57	2,73	2,86	2,99	3,12	3,24	3,35	3,46	3,57	3,65
15°	1,21	1,29	1,37	1,45	1,53	1,60	1,68	1,75	1,82	1,89	1,97	2,03	2,16	2,28	2,40	2,51	2,61	2,71	2,80	2,89	2,94	3,01
16°	1,00	1,06	1,12	1,19	1,25	1,31	1,37	1,43	1,49	1,54	1,60	1,65	1,75	1,84	1,94	2,02	2,09	2,17	2,23	2,30	2,36	2,42
17°	0,76	0,82	0,86	0,91	0,96	1,00	1,05	1,09	1,14	1,18	1,22	1,25	1,32	1,39	1,46	1,52	1,57	1,63	1,67	1,71	1,75	1,79
18°	0,53	0,56	0,59	0,63	0,65	0,69	0,72	0,74	0,77	0,80	0,82	0,85	0,90	0,95	0,99	1,02	1,05	1,09	1,13	1,16	1,18	1,20
19°	0,28	0,30	0,31	0,33	0,35	0,36	0,38	0,39	0,41	0,42	0,43	0,43	0,46	0,48	0,50	0,52	0,54	0,55	0,57	0,58	0,59	0,60
20°																						
21°	0,28	0,29	0,31	0,33	0,34	0,36	0,37	0,39	0,40	0,41	0,43	0,44	0,46	0,48	0,51	0,54	0,56	0,57	0,58	0,59	0,60	0,60
22°	0,55	0,58	0,61	0,64	0,67	0,70	0,73	0,76	0,78	0,81	0,84	0,87	0,93	0,97	1,02	1,06	1,09	1,12	1,15	1,17	1,19	1,19
23°	0,85	0,90	0,95	0,99	1,04	1,08	1,12	1,16	1,21	1,25	1,29	1,32	1,39	1,46	1,52	1,58	1,62	1,68	1,72	1,75	1,77	1,79
24°	1,15	1,19	1,25	1,31	1,37	1,43	1,48	1,54	1,60	1,65	1,71	1,76	1,86	1,95	2,04	2,11	2,17	2,23	2,29	2,33	2,35	2,37
25°	1,44	1,52	1,59	1,67	1,74	1,81	1,88	1,95	2,02	2,09	2,16	2,22	2,34	2,45	2,55	2,64	2,74	2,81	7,87	2,90	2,92	2,96
26°	1,76	1,84	1,93	2,02	2,10	2,18	2,25	2,33	2,41	2,49	2,56	2,64	2,78	2,91	3,03	3,15	3,26	3,37	3,47	3,55	3,62	3,60
27°	2,07	2,16	2,26	2,36	2,46	2,56	2,65	2,74	2,83	2,91	3,00	3,07	3,24	3,39	3,55	3,69	3,82	3,94	4,04	4,14	4,23	4,30
28°	2,39	2,51	2,63	2,74	2,85	2,96	3,06	3,16	3,28	3,38	3,48	3,57	3,75	3,92	4,08	4,23	4,37	4,51	4,62	4,73	4,80	4,86
29°	2,74	2,86	2,97	3,09	3,22	3,34	3,46	3,57	3,69	3,90	3,90	4,00	4,20	4,39	4,58	4,74	4,90	5,05	5,19	5,31	5,40	5,48
30°	3,06	3,21	3,35	3,50	3,63	3,77	3,91	4,02	4,15	4,28	4,40	4,52	4,75	4,96	5,16	5,35	5,52	5,67	5,79	5,91	5,99	6,04

Note: This table can be used to convert d_{20}^{t} to d_{20}^{20}

Table VII

Temperature corrections *c* required for the density of dessert wines,
measured in an *ordinary-glass* pycnometer, or hydrometer at *t* °C to correct this to 20 °C.

$$\rho_{20} = \rho_t \pm \frac{c}{1000} \quad \begin{array}{l} - \text{ if } t^o \text{ is less than } 20\ ^oC \\ + \text{ if } t^o \text{ is more than } 20\ ^oC \end{array}$$

Temperature in °C	13% vol. wine							15% vol. wine							17% vol. wine						
	Density							Density							Density						
	1,000	1,020	1,040	1,060	1,080	1,100	1,120	1,000	1,020	1,040	1,060	1,080	1,100	1,120	1,000	1,020	1,040	1,060	1,080	1,100	1,120
10°	2,24	2,58	2,93	3,27	3,59	3,89	4,18	2,51	2,85	3,20	3,54	3,85	4,02	4,46	2,81	3,15	3,50	3,84	4,15	4,45	4,74
11°	2,06	2,37	2,69	2,97	3,26	3,53	3,78	2,31	2,61	2,93	3,21	3,51	3,64	4,02	2,57	2,89	3,20	3,49	3,77	4,03	4,28
12°	1,87	2,14	2,42	2,67	2,94	3,17	3,40	2,09	2,36	2,64	2,90	3,16	3,27	3,61	2,32	2,60	2,87	3,13	3,39	3,63	3,84
13°	1,69	1,93	2,14	2,37	2,59	2,80	3,00	1,88	2,12	2,34	2,56	2,78	2,88	3,19	2,09	2,33	2,55	2,77	2,98	3,19	3,39
14°	1,49	1,70	1,90	2,09	2,27	2,44	2,61	1,67	1,86	2,06	2,25	2,45	2,51	2,77	1,83	2,03	2,23	2,42	2,61	2,77	2,94
15°	1,25	1,42	1,59	1,75	1,90	2,05	2,19	1,39	1,56	1,72	1,88	2,03	2,11	2,32	1,54	1,71	1,87	2,03	2,18	2,32	2,47
16°	1,03	1,17	1,30	1,43	1,55	1,67	1,78	1,06	1,27	1,40	1,53	1,65	1,77	1,88	1,25	1,39	1,52	1,65	1,77	1,89	2,00
17°	0,80	0,90	1,00	1,09	1,17	1,27	1,36	0,87	0,98	1,08	1,17	1,26	1,35	1,44	0,96	1,06	1,16	1,26	1,35	1,44	1,52
18°	0,54	0,61	0,68	0,75	0,81	0,86	0,92	0,60	0,66	0,73	0,80	0,85	0,91	0,97	0,66	0,72	0,79	0,86	0,92	0,97	1,03
19°	0,29	0,33	0,36	0,39	0,42	0,45	0,48	0,32	0,36	0,39	0,42	0,45	0,48	0,51	0,35	0,38	0,41	0,45	0,48	0,51	0,53
20°																					
21°	0,29	0,32	0,35	0,39	0,42	0,45	0,47	0,32	0,35	0,38	0,42	0,45	0,48	0,50	0,34	0,38	0,41	0,44	0,47	0,50	0,53
22°	0,57	0,64	0,70	0,76	0,82	0,88	0,93	0,63	0,69	0,75	0,81	0,87	0,93	0,99	0,68	0,75	0,81	0,87	0,93	0,99	1,04
23°	0,89	0,98	1,08	1,17	1,26	1,34	1,43	0,97	1,06	1,16	1,25	1,34	1,42	1,51	1,06	1,15	1,25	1,34	1,42	1,51	1,59
24°	1,22	1,34	1,44	1,56	1,68	1,79	1,90	1,32	1,44	1,54	1,66	1,78	1,89	2,00	1,43	1,56	1,65	1,77	1,89	2,00	2,11
25°	1,61	1,68	1,83	1,98	2,12	2,26	2,40	1,66	1,81	1,96	2,11	2,25	2,39	2,52	1,80	1,94	2,09	2,24	2,39	2,52	2,66
26°	1,87	2,05	2,22	2,40	2,56	2,71	2,87	2,02	2,20	2,37	2,54	2,70	2,85	3,01	2,18	2,36	2,53	2,71	2,86	3,02	3,17
27°	2,21	2,42	2,60	2,80	3,00	3,18	3,35	2,39	2,59	2,78	2,98	3,17	3,35	3,52	2,58	2,78	2,97	3,17	3,36	3,54	3,71
28°	2,56	2,80	3,02	3,25	3,47	3,67	3,89	2,75	2,89	3,22	3,44	3,66	3,96	4,07	2,97	3,21	3,44	3,66	3,88	4,09	4,30
29°	2,93	3,19	3,43	3,66	3,91	4,14	4,37	3,16	3,41	3,65	3,89	4,13	4,36	4,59	3,40	3,66	3,89	4,13	4,38	4,61	4,82
30°	3,31	3,57	3,86	4,15	4,41	4,66	4,92	3,55	3,81	4,10	4,38	4,66	4,90	5,16	3,82	4,08	4,37	4,65	4,93	5,17	5,42

Table VII (cont'd)

Temperature corrections *c* required for the density of dessert wines,
measured in an *ordinary-glass* pycnometer, or hydrometer at *t* °C to correct this to 20 °C.

$$\rho_{20} = \rho_t \pm \frac{c}{1000} \quad \begin{array}{l} - \text{ if } t^o \text{ is less than } 20\ ^oC \\ + \text{ if } t^o \text{ is more than } 20\ ^oC \end{array}$$

	19 % vol. wine							21 % vol. wine						
	Density							Density						
Temperatures in °C	1,0	1,0	1,0	1,0	1,0	1,1	1,1	1,0	1,0	1,0	1,0	1,0	1,1	1,1
10°	3,1	3,4	3,8	4,1	4,4	4,7	5,0	3,5	3,8	4,1	4,5	4,8	5,1	5,4
11°	2.8	3.1	3.4	3.7	4.0	4.3	4.5	3.1	3.4	3.8	4.0	4.3	4.6	4.8
12°	2.5	2.9	3.1	3.3	3.6	3.8	4.1	2.8	3.1	3.4	3.6	3.9	4.1	4.3
13°	2.3	2.5	2.7	2.9	3.2	3.4	3.6	2.5	2.7	3.0	3.2	3.4	3.6	3.8
14°	2.0	2.2	2.4	2.6	2.8	2.9	3.1	2.2	2.4	2.6	2.8	3.0	3.1	3.3
15°	1,6	1,8	2,0	2,1	2,3	2,4	2,6	1,8	2,0	2,1	2,3	2,5	2,6	2,8
16°	1.3	1.5	1.6	1.7	1.9	2.0	2.1	1.5	1.6	1.7	1.9	2.0	2.1	2.2
17°	1.0	1.1	1.2	1	1.4	1.5	1.6	1.1	1.2	1.3	1.4	1.5	1.6	1.7
18°	0.7	0.7	0.8	0.9	0.9	1.0	1.0	0.7	0.8	0.9	0.9	1.0	1.1	1.1
19°	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5
20°														
21°	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.5
22°	0.7	0.8	0.8	0.9	0.9	1.0	1.1	0.8	0.8	0.9	1.0	1.0	1.1	1.1
23°	1.1	1.3	1.3	1.4	1.5	1.6	1.6	1.2	1.3	1.4	1.6	1.6	1.7	1.7
24°	1.5	1.6	1.7	1.8	2.0	2.1	2.2	1.6	1.8	1.9	2.0	2.1	2.2	2.3
25°	1,9	2,0	2,2	2,3	2,5	2,6	2,7	2,1	2,2	2,4	2,5	2,6	2,8	2,9
26°	2.3	2.5	2.7	2.8	3.0	3.2	3.3	2.5	2.7	2.9	3.0	3.2	3.3	3.5
27°	2.7	2.9	3.1	3.3	3.5	3.7	3.9	3.0	3.2	3.4	3.5	3.7	3.9	4.1
28°	3.2	3.4	3.6	3.8	4.1	4.3	4.5	3.4	3.6	3.9	4.1	4.3	4.5	4.7
29°	3.6	3.9	4.1	4.4	4.6	4.8	5.0	3.9	4.2	4.4	4.6	4.9	5.1	5.3
30°	4,1	4,3	4,6	4,9	5,2	5,4	5,7	4,4	4,6	4,9	5,2	5,5	5,7	6,0

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