

## TN07 — Thermal expansion data for wine

### Scope

The following table is a summary of thermal expansion data for wine, obtained from a variety of sources. The data may be used to predict changes in the volume of wine with temperature during storage, and to calculate headspace/ullage volumes required in bottled wine, in order to prevent or minimise leakage.

Reference	Change in temperature, °C	Alcoholic strength, % v/v	Sugar content, g/L	Thermal Expansion		
				mL/L	mL/750mL	%
Vinkem Pty Ltd	5	NA	NA	1.60	1.20	0.16
	10	NA	NA	3.33	2.50	0.33
	15	NA	NA	4.93	3.70	0.49
	20	NA	NA	6.67	5.00	0.67
	25	NA	NA	8.27	6.20	0.83
	30	NA	NA	9.87	7.40	0.99
Levreau et al. 1977	10	10	<2	0.90	0.68	0.09
	20	10	<2	3.00	2.25	0.30
	30	10	<2	6.30	4.73	0.63
	40	10	<2	10.40	7.80	1.04
	50	10	<2	15.20	11.40	1.52
	60	10	<2	20.50	15.38	2.05
	10	12	<2	1.10	0.83	0.11
	20	12	<2	3.40	2.55	0.34
	30	12	<2	6.80	5.10	0.68
	40	12	<2	11.10	8.33	1.11
	50	12	<2	16.20	12.15	1.62
	60	12	<2	21.80	16.35	2.18
	10	14	<2	1.50	1.13	0.15
	20	14	<2	4.00	3.00	0.40
	30	14	<2	7.50	5.63	0.75
	40	14	<2	11.90	8.93	1.19
	50	14	<2	17.20	12.90	1.72
	60	14	<2	23.00	17.25	2.30
	10	14	100	2.10	1.58	0.21
	20	14	100	5.20	3.90	0.52
	30	14	100	9.00	6.75	0.90
	40	14	100	13.80	10.35	1.38
	50	14	100	19.20	14.40	1.92
	60	14	100	25.30	18.98	2.53
Tremblay 1984	10	12	NA	3.07	2.30	0.31

In addition to the above references, Vannobel (1990) developed a mathematical formula which may be used to predict the expansion of bottled wine when subjected to an increase in temperature. Using this formula and the

geometry of the neck of the bottle one can determine the appropriate headspace to reduce possible leakage due to internal pressures caused by expansion. The reference is available from the Institute on request.

**References**

Vinkem P/L Promotional Literature : Wine Expansion Table

Leveau, R; Lefebvre, A; Serrano, M; Ribereau-Gayon, P Etude du bouchage liege 1. Role des supressions dans l'apparitions des `bouteilles couleuses', bouchage sous gaz carbonique *Connaiss. Vigne Vin* 11:351-77, 1977

Tremblay, J L'influence de la tempurature sur le transport des vins par containers *Rev. Fr. Oenol.* 24(96) 11-18, 1984

Vannobel, C. Changes in bottled wine volumes. *Rev. Fr. Oenol.* 125: 41-46; 1990.