Council Directive of 27 July 1976 on the approximation of the laws of the Member States relating to alcohol tables (76/766/EEC) (repealed)

ANNEX

ALCOHOLIC STRENGTH

1. DEFINITION

The ‘alcoholic strength by volume’ of a mixture of water and ethanol is the ratio of the volume of pure alcohol present in the mixture at 20 °C to the total volume of the mixture at the same temperature.

The ‘alcoholic strength by mass’ of a mixture of water and ethanol is the ratio of the mass of alcohol present in this mixture to the total mass of the mixture.

2. EXPRESSION OF ALCOHOLIC STRENGTH

The alcoholic strength is expressed as the parts of alcohol per hundred parts of the mixture.

The relevant symbols are:

‘% vol’ for the alcoholic strength by volume,

‘% mas’ for the alcoholic strength by mass.

3. DETERMINATION OF ALCOHOLIC STRENGTH

The procedures to be carried out to determine the alcoholic strength by means of the instruments provided for in the Council Directive of 27 July 1976 on the approximation of the laws of the Member States relating to alcoholometers and alcohol hydrometers[(1)] shall be as follows:

— the reading of an alcoholometer or alcohol hydrometer, at the temperature of the mixture,

— the measurement of the temperature of the mixture.

The results shall be obtained from the international alcohol tables.

4. FORMULA FOR THE CALCULATION OF INTERNATIONAL ALCOHOL TABLES FOR MIXTURES OF WATER AND ETHANOL

The density ‘ρ’, expressed in kilogrammes per cubic metre (kg/m^3), of a mixture of water and ethanol at a temperature (t), expressed in degrees Celsius, is given by the following formula as a function of:

— the proportion by mass ‘p’, expressed as a decimal number[(2)],

— the temperature ‘t’, expressed in degrees Celsius (IPTS-68),

— the numerical coefficients given below.

This formula is valid for temperatures in the range —20 to +40 °C.

$$\rho = A_1 + \sum_{k=2}^{12} A_k p^{k-1} + \sum_{k=1}^{6} B_k (t - 20oC)^k + \sum_{i=1}^{n} \sum_{k=1}^{m_i} C_{i,k} p^k (t - 20oC)^i$$

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n	=	5
m_1	=	11
m_2	=	10
m_3	=	9
m_4	=	4
m_5	=	2

NUMERICAL COEFFICIENTS IN THE FORMULA

	A_k	B_k
k	**kg/m^3**	
1	9,982 012 300 · 10^2	—2,061 851 3 · 10^{-1} kg/(m^3 · ^oC)
2	—1,929 769 495 · 10^2	—5,268 254 2 · 10^{-3} kg/(m^3 · $^oC^2$)
3	3,891 238 958 · 10^2	3,613 001 3 · 10^{-5} kg/(m^3 · $^oC^3$)
4	—1,668 103 923 · 10^3	—3,895 770 2 · 10^{-7} kg/(m^3 · $^oC^4$)
5	1,352 215 441 · 10^4	7,169 354 0 · 10^{-9} kg/(m^3 · $^oC^5$)
6	—8,829 278 388 · 10^4	—9,973 923 1 · 10^{-11} kg/(m^3 · $^oC^6$)
7	3,062 874 042 · 10^5	
8	—6,138 381 234 · 10^5	
9	7,470 172 998 · 10^5	
10	—5,478 461 354 · 10^5	
11	2,234 460 334 · 10^5	
12	—3,903 285 426 · 10^4	

	$C_{1,k}$	$C_{2,k}$
	kg/(m^3 · ^{o}C)	**kg/(m^3 · ^{o}C^2)**
1	1,693 443 461 530 087 · 10^{-1}	—1,193 013 005 057 010 · 10^{-2}
2	—1,046 914 743 455 169 · 10^1	2,517 399 633 803 461 · 10^{-1}
3	7,196 353 469 546 523 · 10^1	—2,170 575 700 536 993
4	—7,047 478 054 272 792 · 10^2	1,353 034 988 843 029 · 10^1
5	3,924 090 430 035 045 · 10^3	—5,029 988 758 547 014 · 10^1
6	—1,210 164 659 068 747 · 10^4	1,096 355 666 577 570 · 10^2
7	2,248 646 550 400 788 · 10^4	—1,422 753 946 421 155 · 10^2

8	—2,605 562 982 188 164 · 10^{4}	1,080 435 942 856 230 · 10^{2}
9	1,852 373 922 069 467 · 10^{4}	—4,414 153 236 817 392 · 10^{1}
10	—7,420 201 433 430 137 · 10^{3}	7,442 971 530 188 783
11	1,285 617 841 998 974 · 10^{3}	

	$C_{3,k}$	$C_{4,k}$	$C_{5,k}$
k	**kg/(m^3 · ^{o}C^3)**	**kg/(m^3 · ^{o}C^4)**	**kg/(m^3 · ^{o}C^5)**
1	—6,802 995 733 503 803 · 10^{-4}	4,075 376 675 622 027· 10^{-6}	—2,788 074 354 782 409 · 10^{-3}
2	1,876 837 790 289 664 · 10^{-2}	—8,763 058 573 471 110 · 10^{-6}	1,345 612 883 493 354 · 10^{-8}
3	—2,002 561 813 734 156 · 10^{-1}	6,515 031 360 099 368 · 10^{-6}	
4	1,022 992 966 719 220	—1,515 784 836 987 210· 10^{-6}	
5	—2,895 696 483 903 638		
6	4,810 060 584 300 675		
7	—4,672 147 440 794 683		
8	2,458 043 105 903 461		
9	—5,411 227 621 436 812 · 10^{-1}		

(**1**) See page 143 of this Official Journal.

(**2**) *Example:* for a proportion by mass of 12%, p = 0·12.