



## CARGILLE LABORATORIES

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### Certified Water References

The authority for the absolute refractive index of water is the IAPWS ( The International Association for the Properties of Water and Steam, [www.iapws.org](http://www.iapws.org) ). For the NIST Scientific and Technical Database based on the IAPWS see [www.nist.gov/srd/nist10.htm](http://www.nist.gov/srd/nist10.htm). The absolute refractive index of air can be calculated using the following formulas found in the American Institute of Physics Handbook (page 6-111 of the 3d edition ).

$$(n - 1)10^8 = 6,432.8 + ( 2,949,810 / 146 - \sigma^2 ) + ( 25,540 / 41 - \sigma^2 )$$

( Note : this formula is for the absolute refractive index of air at 15 °C and 760 mm Hg;  $n_{15,760}$  see below )

where  $\sigma$  is the wave number in  $\mu\text{m}^{-1}$  ( wave number =  $10^3 / \text{wavelength in nm}$  )

The change in refractive index with temperature and pressure can be calculated using the following.

$$n_{Tp} - 1 = ( n_{15,760} - 1 ) \times ( p( 1 + \beta_T)( 1 + 15\alpha ) ) / ( 760( 1 + 760\beta_{15})( 1 + \alpha T ) )$$

where  $T$  = temperature ( °C )

$p$  = pressure ( mm Hg )

$\alpha = 0.00366$

$\beta_T = ( 1.049 - 0.015^7 T ) 10^{-6}$

$\beta_{15} = 0.813^5 \times 10^{-6}$

The absolute refractive index, using 589.3 nm light, of Water and Air at 760 mm Hg Air Pressure\*

<u>Temperature in °C</u>	<u>Water</u>	<u>Air</u>
10	1.334049	1.000282
15	1.333740	1.000277
20	1.333336	1.000272
23	1.333051	1.000270
25	1.332845	1.000268
30	1.332277	1.000263
35	1.331638	1.000259

\* Note : air pressure will affect the refractive index of air. For example: at 25 °C air is 1.000268 at 760 mm Hg ( sea level ) and 1.000223 at 632 mm Hg ( such as at an elevation of 5000 feet )