

NATIONAL MEASUREMENT ACT 1960

DETERMINATION BY THE NATIONAL STANDARDS COMMISSION

Recognized-Value Standard of Measurement of Density

Water

In pursuance of paragraphs 8A(1) (a) and (b) of the National Measurement Act 1960, the National Standards Commission hereby determines that the magnitude of the density of water d_t at a temperature t and a mean pressure p shall be a recognised-value standard of measurement, provided t lies within the range 0°C to 40°C and p lies within the range 2×10^4 Pa to 10^6 Pa.

For the purposes of this Determination -

- (a) when p is 101 325 Pa and t is one of the temperatures listed in the attached table the magnitude of the density in kg.m^{-3} is as stated in the table, which is derived from the following formula:

$$d_t = 999.972 - \frac{(t - 3.984\ 9)^2}{506.603\ 12} \times \frac{(t + 286.460\ 1)}{(t + 67.760\ 1)}$$

where d_t is the density in kg.m^{-3} , and

t is the temperature in °C;

- (b) when p is 101 325 Pa and t is between two adjacent values of temperature listed in the attached table then the magnitude of the density in kg.m^{-3} shall be determined from the table by linear interpolation;
- (c) when p differs from 101 325 Pa the magnitude of the density in kg.m^{-3} as stated in the attached table or derived therefrom in accordance with the above linear interpolation shall be algebraically increased by an amount equal to $(5.061\ 9 - 0.030\ 9\ t + 0.000\ 361\ 4\ t^2) \times 10^{-7}(p - 101\ 325)$; and
- (d) if the value of t used in the attached table and the above equations does not differ from the true mean temperature of the water by more than 0.1°C, if the value of p used in the equation does not differ from the true mean pressure within the water by more than 1 000 Pa, and if impurities in the water do not exceed 1 part in 10^5 by mass, the chance is not more than one in one hundred that the density so ascertained differs from the true density by more than 0.05 kg.m^{-3} .

Dated this 21st day of March 1985

The COMMON SEAL OF THE NATIONAL
STANDARDS COMMISSION was hereto
affixed by authority of the
Commission in the presence of

T.J. PETRY

THE DENSITY OF WATER IN KILOGRAMS PER CUBIC METRE AS A FUNCTION OF THE TEMPERATURE IN DEGREES CELSIUS

| TEMP | DENSITY | TEMP | DENSITY | TEMP | DENSITY | TEMP | DENSITY | TEMP | DENSITY | TEMP | DENSITY | TEMP | DENSITY | TEMP | DENSITY |
|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|------|---------|
| 0.0 | 999.839 | 5.0 | 999.964 | 10.0 | 999.700 | 15.0 | 999.100 | 20.0 | 998.204 | 25.0 | 997.045 | 30.0 | 995.647 | 35.0 | 994.032 |
| 0.1 | 999.846 | 5.1 | 999.962 | 10.1 | 999.691 | 15.1 | 999.084 | 20.1 | 998.183 | 25.1 | 997.019 | 30.1 | 995.617 | 35.1 | 993.998 |
| 0.2 | 999.853 | 5.2 | 999.960 | 10.2 | 999.682 | 15.2 | 999.069 | 20.2 | 998.163 | 25.2 | 996.993 | 30.2 | 995.587 | 35.2 | 993.963 |
| 0.3 | 999.859 | 5.3 | 999.958 | 10.3 | 999.673 | 15.3 | 999.054 | 20.3 | 998.142 | 25.3 | 996.968 | 30.3 | 995.556 | 35.3 | 993.929 |
| 0.4 | 999.865 | 5.4 | 999.956 | 10.4 | 999.663 | 15.4 | 999.038 | 20.4 | 998.121 | 25.4 | 996.942 | 30.4 | 995.526 | 35.4 | 993.894 |
| 0.5 | 999.871 | 5.5 | 999.954 | 10.5 | 999.654 | 15.5 | 999.023 | 20.5 | 998.100 | 25.5 | 996.916 | 30.5 | 995.495 | 35.5 | 993.859 |
| 0.6 | 999.877 | 5.6 | 999.952 | 10.6 | 999.645 | 15.6 | 999.007 | 20.6 | 998.078 | 25.6 | 996.889 | 30.6 | 995.465 | 35.6 | 993.824 |
| 0.7 | 999.883 | 5.7 | 999.949 | 10.7 | 999.635 | 15.7 | 998.991 | 20.7 | 998.057 | 25.7 | 996.863 | 30.7 | 995.434 | 35.7 | 993.790 |
| 0.8 | 999.888 | 5.8 | 999.946 | 10.8 | 999.625 | 15.8 | 998.975 | 20.8 | 998.036 | 25.8 | 996.837 | 30.8 | 995.403 | 35.8 | 993.755 |
| 0.9 | 999.893 | 5.9 | 999.943 | 10.9 | 999.615 | 15.9 | 998.959 | 20.9 | 998.014 | 25.9 | 996.810 | 30.9 | 995.372 | 35.9 | 993.719 |
| 1.0 | 999.898 | 6.0 | 999.940 | 11.0 | 999.605 | 16.0 | 998.943 | 21.0 | 997.992 | 26.0 | 996.784 | 31.0 | 995.341 | 36.0 | 993.684 |
| 1.1 | 999.903 | 6.1 | 999.937 | 11.1 | 999.595 | 16.1 | 998.927 | 21.1 | 997.971 | 26.1 | 996.757 | 31.1 | 995.310 | 36.1 | 993.649 |
| 1.2 | 999.908 | 6.2 | 999.934 | 11.2 | 999.585 | 16.2 | 998.910 | 21.2 | 997.949 | 26.2 | 996.730 | 31.2 | 995.279 | 36.2 | 993.614 |
| 1.3 | 999.913 | 6.3 | 999.930 | 11.3 | 999.574 | 16.3 | 998.894 | 21.3 | 997.927 | 26.3 | 996.704 | 31.3 | 995.248 | 36.3 | 993.578 |
| 1.4 | 999.917 | 6.4 | 999.927 | 11.4 | 999.564 | 16.4 | 998.877 | 21.4 | 997.905 | 26.4 | 996.677 | 31.4 | 995.216 | 36.4 | 993.543 |
| 1.5 | 999.921 | 6.5 | 999.923 | 11.5 | 999.553 | 16.5 | 998.860 | 21.5 | 997.883 | 26.5 | 996.650 | 31.5 | 995.185 | 36.5 | 993.508 |
| 1.6 | 999.925 | 6.6 | 999.919 | 11.6 | 999.542 | 16.6 | 998.843 | 21.6 | 997.860 | 26.6 | 996.623 | 31.6 | 995.153 | 36.6 | 993.472 |
| 1.7 | 999.929 | 6.7 | 999.915 | 11.7 | 999.531 | 16.7 | 998.827 | 21.7 | 997.838 | 26.7 | 996.595 | 31.7 | 995.122 | 36.7 | 993.436 |
| 1.8 | 999.933 | 6.8 | 999.910 | 11.8 | 999.520 | 16.8 | 998.809 | 21.8 | 997.816 | 26.8 | 996.568 | 31.8 | 995.090 | 36.8 | 993.400 |
| 1.9 | 999.936 | 6.9 | 999.906 | 11.9 | 999.509 | 16.9 | 998.792 | 21.9 | 997.793 | 26.9 | 996.541 | 31.9 | 995.058 | 36.9 | 993.365 |
| 2.0 | 999.940 | 7.0 | 999.902 | 12.0 | 999.497 | 17.0 | 998.775 | 22.0 | 997.770 | 27.0 | 996.513 | 32.0 | 995.026 | 37.0 | 993.329 |
| 2.1 | 999.943 | 7.1 | 999.897 | 12.1 | 999.486 | 17.1 | 998.757 | 22.1 | 997.748 | 27.1 | 996.486 | 32.1 | 994.995 | 37.1 | 993.293 |
| 2.2 | 999.946 | 7.2 | 999.892 | 12.2 | 999.474 | 17.2 | 998.740 | 22.2 | 997.725 | 27.2 | 996.458 | 32.2 | 994.962 | 37.2 | 993.257 |
| 2.3 | 999.949 | 7.3 | 999.887 | 12.3 | 999.463 | 17.3 | 998.722 | 22.3 | 997.702 | 27.3 | 996.430 | 32.3 | 994.930 | 37.3 | 993.221 |
| 2.4 | 999.952 | 7.4 | 999.882 | 12.4 | 999.451 | 17.4 | 998.704 | 22.4 | 997.679 | 27.4 | 996.403 | 32.4 | 994.898 | 37.4 | 993.184 |
| 2.5 | 999.954 | 7.5 | 999.877 | 12.5 | 999.439 | 17.5 | 998.687 | 22.5 | 997.656 | 27.5 | 996.375 | 32.5 | 994.866 | 37.5 | 993.148 |
| 2.6 | 999.956 | 7.6 | 999.871 | 12.6 | 999.427 | 17.6 | 998.669 | 22.6 | 997.632 | 27.6 | 996.347 | 32.6 | 994.834 | 37.6 | 993.112 |
| 2.7 | 999.959 | 7.7 | 999.866 | 12.7 | 999.415 | 17.7 | 998.650 | 22.7 | 997.609 | 27.7 | 996.318 | 32.7 | 994.801 | 37.7 | 993.075 |
| 2.8 | 999.961 | 7.8 | 999.860 | 12.8 | 999.402 | 17.8 | 998.632 | 22.8 | 997.586 | 27.8 | 996.290 | 32.8 | 994.769 | 37.8 | 993.039 |
| 2.9 | 999.962 | 7.9 | 999.854 | 12.9 | 999.390 | 17.9 | 998.614 | 22.9 | 997.562 | 27.9 | 996.262 | 32.9 | 994.736 | 37.9 | 993.002 |
| 3.0 | 999.964 | 8.0 | 999.848 | 13.0 | 999.377 | 18.0 | 998.596 | 23.0 | 997.538 | 28.0 | 996.234 | 33.0 | 994.703 | 38.0 | 992.965 |
| 3.1 | 999.966 | 8.1 | 999.842 | 13.1 | 999.364 | 18.1 | 998.577 | 23.1 | 997.515 | 28.1 | 996.205 | 33.1 | 994.670 | 38.1 | 992.929 |
| 3.2 | 999.967 | 8.2 | 999.836 | 13.2 | 999.352 | 18.2 | 998.558 | 23.2 | 997.491 | 28.2 | 996.177 | 33.2 | 994.638 | 38.2 | 992.892 |
| 3.3 | 999.968 | 8.3 | 999.830 | 13.3 | 999.339 | 18.3 | 998.540 | 23.3 | 997.467 | 28.3 | 996.148 | 33.3 | 994.605 | 38.3 | 992.855 |
| 3.4 | 999.969 | 8.4 | 999.823 | 13.4 | 999.326 | 18.4 | 998.521 | 23.4 | 997.443 | 28.4 | 996.119 | 33.4 | 994.572 | 38.4 | 992.818 |
| 3.5 | 999.970 | 8.5 | 999.816 | 13.5 | 999.312 | 18.5 | 998.502 | 23.5 | 997.419 | 28.5 | 996.090 | 33.5 | 994.539 | 38.5 | 992.781 |
| 3.6 | 999.971 | 8.6 | 999.810 | 13.6 | 999.299 | 18.6 | 998.483 | 23.6 | 997.394 | 28.6 | 996.062 | 33.6 | 994.505 | 38.6 | 992.743 |
| 3.7 | 999.971 | 8.7 | 999.803 | 13.7 | 999.286 | 18.7 | 998.463 | 23.7 | 997.370 | 28.7 | 996.033 | 33.7 | 994.472 | 38.7 | 992.706 |
| 3.8 | 999.972 | 8.8 | 999.795 | 13.8 | 999.272 | 18.8 | 998.444 | 23.8 | 997.346 | 28.8 | 996.003 | 33.8 | 994.439 | 38.8 | 992.669 |
| 3.9 | 999.972 | 8.9 | 999.788 | 13.9 | 999.258 | 18.9 | 998.425 | 23.9 | 997.321 | 28.9 | 995.974 | 33.9 | 994.405 | 38.9 | 992.632 |
| 4.0 | 999.972 | 9.0 | 999.781 | 14.0 | 999.244 | 19.0 | 998.405 | 24.0 | 997.297 | 29.0 | 995.945 | 34.0 | 994.372 | 39.0 | 992.594 |
| 4.1 | 999.972 | 9.1 | 999.773 | 14.1 | 999.230 | 19.1 | 998.386 | 24.1 | 997.272 | 29.1 | 995.916 | 34.1 | 994.338 | 39.1 | 992.557 |
| 4.2 | 999.972 | 9.2 | 999.766 | 14.2 | 999.216 | 19.2 | 998.366 | 24.2 | 997.247 | 29.2 | 995.886 | 34.2 | 994.304 | 39.2 | 992.519 |
| 4.3 | 999.971 | 9.3 | 999.758 | 14.3 | 999.202 | 19.3 | 998.346 | 24.3 | 997.222 | 29.3 | 995.857 | 34.3 | 994.271 | 39.3 | 992.481 |
| 4.4 | 999.971 | 9.4 | 999.750 | 14.4 | 999.188 | 19.4 | 998.326 | 24.4 | 997.197 | 29.4 | 995.827 | 34.4 | 994.237 | 39.4 | 992.444 |
| 4.5 | 999.970 | 9.5 | 999.742 | 14.5 | 999.173 | 19.5 | 998.306 | 24.5 | 997.172 | 29.5 | 995.797 | 34.5 | 994.203 | 39.5 | 992.406 |
| 4.6 | 999.969 | 9.6 | 999.734 | 14.6 | 999.159 | 19.6 | 998.286 | 24.6 | 997.147 | 29.6 | 995.768 | 34.6 | 994.169 | 39.6 | 992.368 |
| 4.7 | 999.968 | 9.7 | 999.725 | 14.7 | 999.144 | 19.7 | 998.266 | 24.7 | 997.121 | 29.7 | 995.738 | 34.7 | 994.135 | 39.7 | 992.330 |
| 4.8 | 999.967 | 9.8 | 999.717 | 14.8 | 999.130 | 19.8 | 998.245 | 24.8 | 997.096 | 29.8 | 995.708 | 34.8 | 994.101 | 39.8 | 992.292 |
| 4.9 | 999.965 | 9.9 | 999.708 | 14.9 | 999.115 | 19.9 | 998.225 | 24.9 | 997.071 | 29.9 | 995.678 | 34.9 | 994.066 | 39.9 | 992.254 |
| 5.0 | 999.964 | 10.0 | 999.700 | 15.0 | 999.100 | 20.0 | 998.204 | 25.0 | 997.045 | 30.0 | 995.647 | 35.0 | 994.032 | 40.0 | 992.215 |