



**ITTC – Recommended  
Procedures**

**7.5-02  
-01-03**  
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**Fresh Water and Seawater Properties**

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02

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|                                                                                   |                                            |                                          |                |
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## Fresh Water and Seawater Properties

### 1. INTRODUCTION

The international standard for the properties of fresh water and seawater are specified by the International Association for the Properties of Water and Steam (IAPWS). The properties available include density, viscosity, thermal conductivity, index of refraction, vapour pressure, speed of sound, and surface tension. Those of liquid water are described in IAPWS (2008a). For this procedure, only the following properties are provided: density, absolute viscosity, kinematic viscosity, and vapour pressure.

In general, the water properties are a function of temperature ( $t$ ), pressure ( $p$ ), and absolute salinity ( $S_A$ ). For fresh water,  $S_A = 0.0$ . In this procedure, data are provided at standard pressure of 0.101325 MPa and as a function of temperature. The temperature scale is the International Temperature Scale 1990 (ITS-90). At non-standard conditions, water properties should be computed from computer codes described in the following paragraphs.

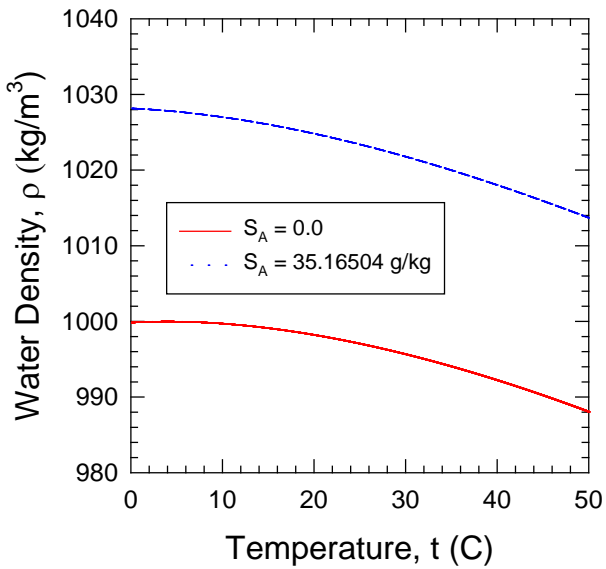
The values for fresh water were computed via a computer code from NIST (National Institute of Standards and Technology), the National Metrology Institute (NMI) for the United States. Harvey, et al. (2008) is the manual for the computer code. The sensitivity coefficients are also provided so that the uncertainty in the property may be computed from the uncertainty in temperature per the 25<sup>th</sup> ITTC proce-

cedure on uncertainty analysis. The uncertainties in the IAPWS equations are also provided.

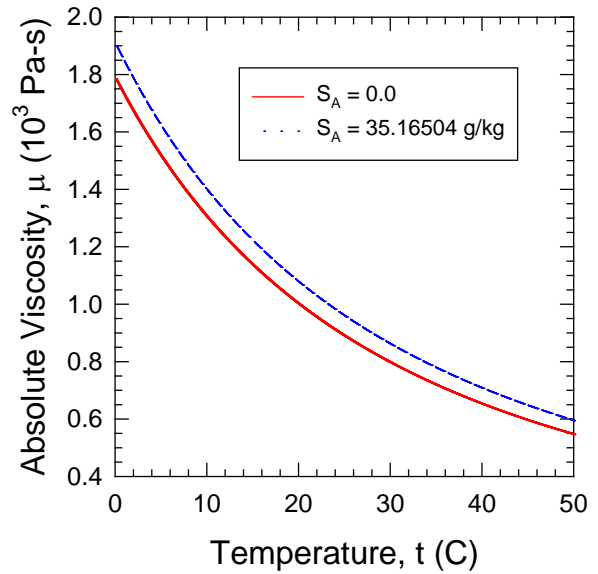
IAPWS (2008b) is the new international standard for seawater properties. The new standard for seawater has been developed by a group at the United Nations and UNESCO (United Nations Educational, Scientific, and Cultural Organization) and several other international organizations. The latest standard for seawater properties is the International Thermodynamic Equation Of Seawater: 2010 (TEOS-10). IOC, et al. (2010) is the manual for the computer code. The code currently calculates thermodynamic properties such as density and vapour pressure. IAPWS (2010) has certified a research need for transport properties such as viscosity. In the meantime for this procedure, viscosity and vapour pressure recommended by Sharqawy, et al. (2010) is adopted. Another source of seawater properties is the SIA (Sea-Ice-Air) library described by Feistel, et al. (2010) and Wright, et al. (2010).

### 2. FRESH WATER PROPERTIES

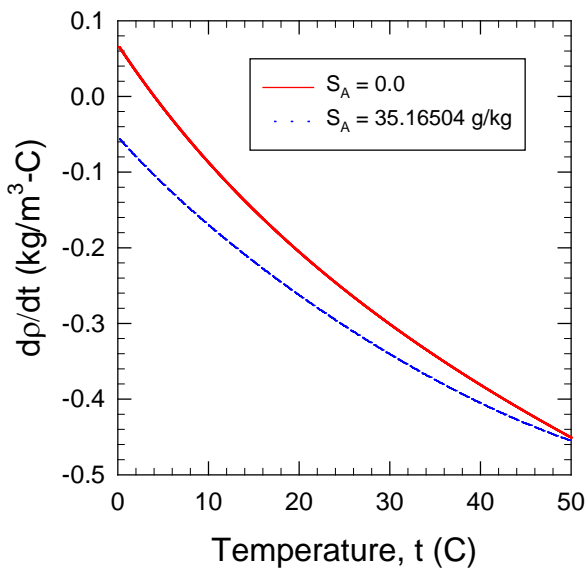
Fresh water properties were computed at the standard pressure of 0.101325 MPa. The results for density, absolute viscosity, kinematic viscosity, vapour pressure, and their sensitivity coefficients are shown in the following graphically in Figure 1 through Figure 4 as  $S_A = 0.0$ . The properties were produced from the NIST code of Harvey, et al. (2008) from 0.1 to 50 °C in 0.1 °C steps, and the sensitivity coefficients were computed by a central finite-differencing method from ISO (2008) given by:



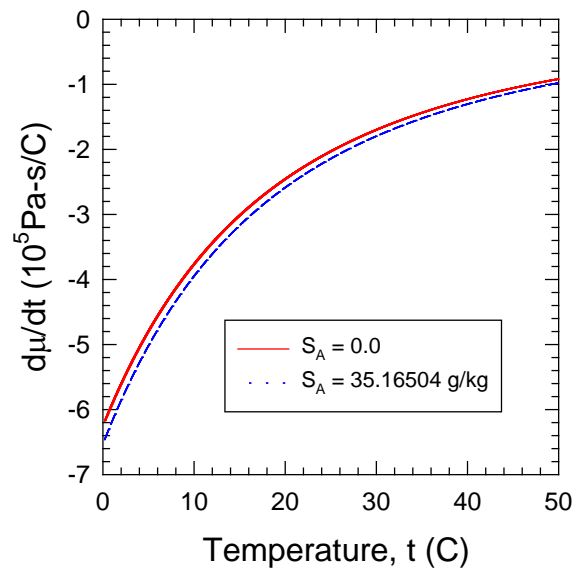
a. Density



a. Absolute viscosity



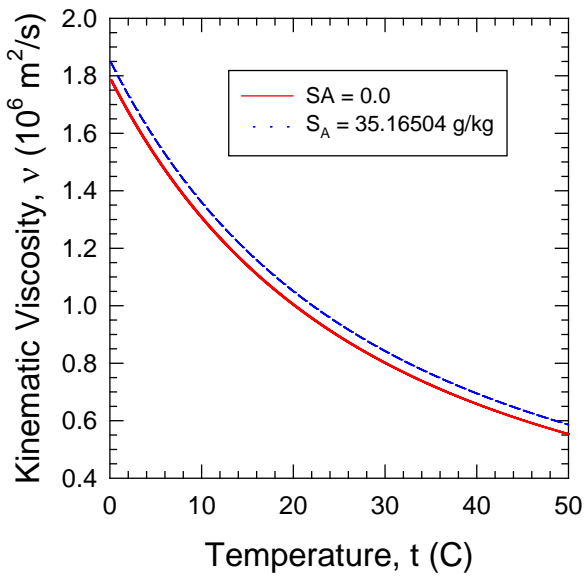
b. Sensitivity coefficient



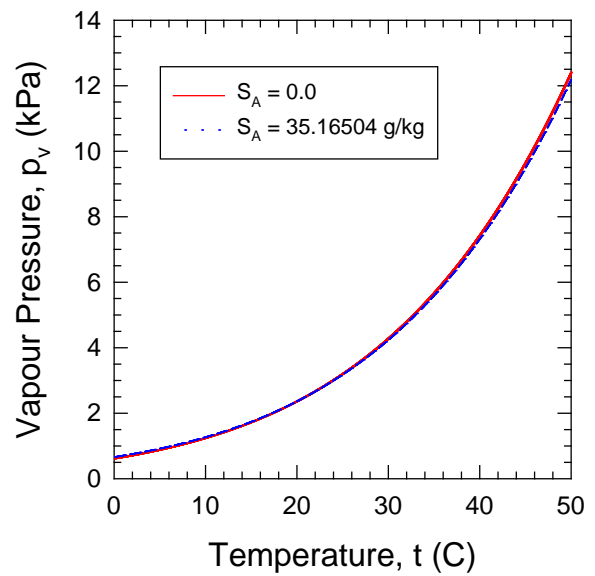
b. Sensitivity coefficient

Figure 1: Fresh water and standard seawater density

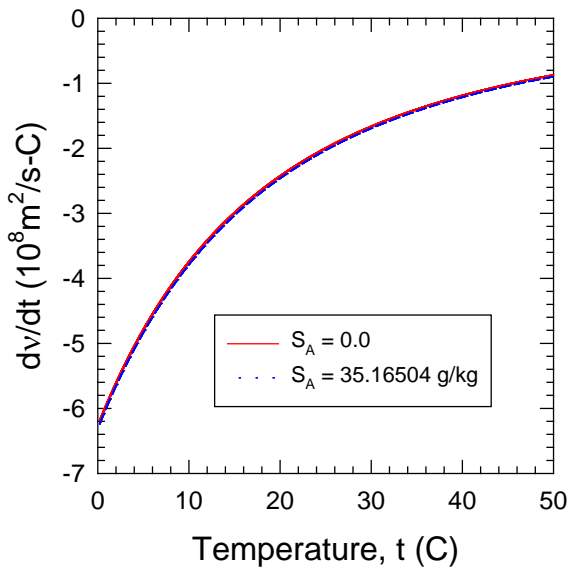
Figure 2: Fresh water and standard seawater absolute viscosity



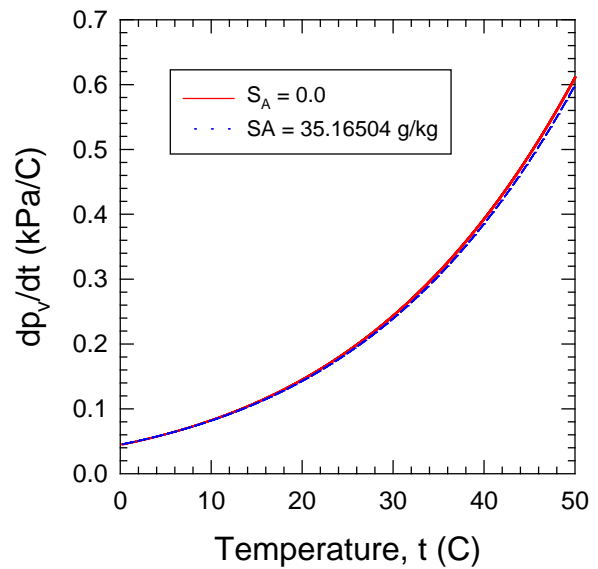
a. Kinematic viscosity



a. Vapour pressure



b. Sensitivity coefficient




b. Sensitivity coefficient

Figure 3: Fresh water and standard seawater kinematic viscosity

Figure 4: Fresh water and standard seawater vapour pressure

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 10               | 999.7025                               | -0.08791                                             | 0.001306                  | -3.760E-05                            | 1.3063E-06                              | -3.749E-08                                         | 1.2282E-03              | 8.230E-05                             |
| 11               | 999.6079                               | -0.10112                                             | 0.001269                  | -3.591E-05                            | 1.2697E-06                              | -3.580E-08                                         | 1.3130E-03              | 8.728E-05                             |
| 12               | 999.5004                               | -0.11399                                             | 0.001234                  | -3.433E-05                            | 1.2347E-06                              | -3.420E-08                                         | 1.4028E-03              | 9.252E-05                             |
| 13               | 999.3801                               | -0.12653                                             | 0.001200                  | -3.284E-05                            | 1.2012E-06                              | -3.271E-08                                         | 1.4981E-03              | 9.802E-05                             |
| 14               | 999.2474                               | -0.13877                                             | 0.001168                  | -3.144E-05                            | 1.1692E-06                              | -3.130E-08                                         | 1.5990E-03              | 1.038E-04                             |
| 15               | 999.1026                               | -0.15071                                             | 0.001138                  | -3.012E-05                            | 1.1386E-06                              | -2.997E-08                                         | 1.7058E-03              | 1.099E-04                             |
| 16               | 998.9461                               | -0.16237                                             | 0.001108                  | -2.887E-05                            | 1.1093E-06                              | -2.872E-08                                         | 1.8188E-03              | 1.162E-04                             |
| 17               | 998.7780                               | -0.17376                                             | 0.001080                  | -2.769E-05                            | 1.0811E-06                              | -2.754E-08                                         | 1.9384E-03              | 1.229E-04                             |
| 18               | 998.5986                               | -0.18489                                             | 0.001053                  | -2.658E-05                            | 1.0542E-06                              | -2.642E-08                                         | 2.0647E-03              | 1.299E-04                             |
| 19               | 998.4083                               | -0.19578                                             | 0.001027                  | -2.553E-05                            | 1.0283E-06                              | -2.537E-08                                         | 2.1983E-03              | 1.372E-04                             |
| 20               | 998.2072                               | -0.20644                                             | 0.001002                  | -2.453E-05                            | 1.0034E-06                              | -2.437E-08                                         | 2.3393E-03              | 1.449E-04                             |
| 21               | 997.9955                               | -0.21687                                             | 0.000978                  | -2.359E-05                            | 9.7950E-07                              | -2.343E-08                                         | 2.4882E-03              | 1.530E-04                             |
| 22               | 997.7735                               | -0.22708                                             | 0.000954                  | -2.270E-05                            | 9.5653E-07                              | -2.253E-08                                         | 2.6453E-03              | 1.614E-04                             |
| 23               | 997.5414                               | -0.23709                                             | 0.000932                  | -2.185E-05                            | 9.3442E-07                              | -2.168E-08                                         | 2.8111E-03              | 1.702E-04                             |
| 24               | 997.2994                               | -0.24691                                             | 0.000911                  | -2.104E-05                            | 9.1315E-07                              | -2.088E-08                                         | 2.9858E-03              | 1.794E-04                             |
| 25               | 997.0476                               | -0.25653                                             | 0.000890                  | -2.028E-05                            | 8.9266E-07                              | -2.011E-08                                         | 3.1699E-03              | 1.890E-04                             |
| 26               | 996.7864                               | -0.26597                                             | 0.000870                  | -1.955E-05                            | 8.7291E-07                              | -1.938E-08                                         | 3.3639E-03              | 1.990E-04                             |
| 27               | 996.5158                               | -0.27524                                             | 0.000851                  | -1.886E-05                            | 8.5388E-07                              | -1.869E-08                                         | 3.5681E-03              | 2.095E-04                             |
| 28               | 996.2360                               | -0.28434                                             | 0.000832                  | -1.820E-05                            | 8.3552E-07                              | -1.803E-08                                         | 3.7831E-03              | 2.205E-04                             |
| 29               | 995.9471                               | -0.29327                                             | 0.000814                  | -1.757E-05                            | 8.1781E-07                              | -1.740E-08                                         | 4.0092E-03              | 2.319E-04                             |
| 30               | 995.6495                               | -0.30206                                             | 0.000797                  | -1.697E-05                            | 8.0071E-07                              | -1.681E-08                                         | 4.2470E-03              | 2.438E-04                             |
| 31               | 995.3431                               | -0.31069                                             | 0.000781                  | -1.640E-05                            | 7.8419E-07                              | -1.624E-08                                         | 4.4969E-03              | 2.562E-04                             |
| 32               | 995.0281                               | -0.31918                                             | 0.000764                  | -1.586E-05                            | 7.6823E-07                              | -1.569E-08                                         | 4.7596E-03              | 2.692E-04                             |
| 33               | 994.7048                               | -0.32753                                             | 0.000749                  | -1.534E-05                            | 7.5280E-07                              | -1.517E-08                                         | 5.0354E-03              | 2.826E-04                             |
| 34               | 994.3731                               | -0.33574                                             | 0.000734                  | -1.484E-05                            | 7.3788E-07                              | -1.467E-08                                         | 5.3251E-03              | 2.967E-04                             |
| 35               | 994.0333                               | -0.34383                                             | 0.000719                  | -1.436E-05                            | 7.2344E-07                              | -1.420E-08                                         | 5.6290E-03              | 3.113E-04                             |
| 36               | 993.6855                               | -0.35179                                             | 0.000705                  | -1.391E-05                            | 7.0947E-07                              | -1.375E-08                                         | 5.9479E-03              | 3.265E-04                             |
| 37               | 993.3298                               | -0.35963                                             | 0.000691                  | -1.347E-05                            | 6.9595E-07                              | -1.331E-08                                         | 6.2823E-03              | 3.424E-04                             |
| 38               | 992.9663                               | -0.36736                                             | 0.000678                  | -1.305E-05                            | 6.8285E-07                              | -1.289E-08                                         | 6.6328E-03              | 3.588E-04                             |
| 39               | 992.5951                               | -0.37497                                             | 0.000665                  | -1.265E-05                            | 6.7015E-07                              | -1.250E-08                                         | 7.0002E-03              | 3.759E-04                             |
| 40               | 992.2164                               | -0.38248                                             | 0.000653                  | -1.227E-05                            | 6.5785E-07                              | -1.211E-08                                         | 7.3849E-03              | 3.937E-04                             |

Table 1: Fresh water properties at 1 °C increment

|                                                                                                                                 |                                            |                                          |                |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------|----------------|
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$$dx/dt \approx (x_{i+1} - x_{i-1})/(2\Delta t) \quad (1)$$

where  $x$  is a water property,  $t$  is the temperature in °C, and  $\Delta t = 0.1$  °C.

Water property numerical values at 1 °C increment from 10 to 40 °C are listed in Table 1. A more detailed list at 0.1 °C increments from 0.1 to 50 °C is located in Appendix A.

## 2.1 Uncertainty estimates for fresh water properties

The uncertainties in the IAWPS equations are summarized in Table 2 for an expanded uncertainty with a coverage factor of 2. For density and viscosity, the uncertainties are from IAWPS (2008a). The uncertainty in vapour pressure is from Harvey, et al. (2008) Figure B-4. The value of  $\pm 0.02$  % is actually the maximum value over the ambient temperature range and is recommended for simplicity.

| Property        | Symbol | $U_{95}$ | Units |
|-----------------|--------|----------|-------|
| Density         | $\rho$ | 1        | ppm   |
| Viscosity       | $\mu$  | 1        | %     |
| Vapour Pressure | $p_v$  | 0.02     | %     |

Table 2: Uncertainty in water properties at 95 % confidence limit [ppm: parts per million (0.0001 %)]

The combined uncertainty then includes both the influence of the uncertainty in temperature and the uncertainty in the IAWPS equations. The combined expanded uncertainty is then

$$U_c = \sqrt{U_x^2 + (c_{x,t} U_t)^2} \quad (2)$$

where  $U_x$  is the uncertainty in the water property equation from Table 2,  $U_t$  the uncertainty in temperature, and  $c_{x,t} = \partial x / \partial t$  the sensitivity coefficient from Table 1 or Appendix A. The uncertainty in temperature should include both Type A and Type B uncertainty estimates from ISO (2008).

### 2.1.1 Example uncertainty calculation of fresh water properties

From the previous section, the following are specific examples of fresh water properties at 20 °C.

For  $U_t = \pm 1.0$  °C:


- Density:  
998.21  $\pm$  0.21 kg/m<sup>3</sup> ( $\pm 0.021$  %)
- Absolute viscosity:  
0.001002  $\pm$  0.000026 Pa·s ( $\pm 2.6$  %)
- Kinematic viscosity:  
(1.003  $\pm$  0.026)  $\times 10^{-6}$  m<sup>2</sup>/s ( $\pm 2.6$  %)
- Vapour pressure:  
2.34  $\pm$  0.14 kPa (6.2 %)

In this example, most of the uncertainty is from the uncertainty in temperature.

For  $U_t = \pm 0.10$  °C:

- Density:  
998.207  $\pm$  0.021 kg/m<sup>3</sup> ( $\pm 0.0021$  %)
- Absolute viscosity:  
0.001002  $\pm$  0.000010 Pa·s ( $\pm 1.0$  %)
- Kinematic viscosity:  
(1.003  $\pm$  0.010)  $\times 10^{-6}$  m<sup>2</sup>/s ( $\pm 1.0$  %)
- Vapour pressure:  
2.339  $\pm$  0.014 kPa (0.62 %)

In this case, most of the uncertainty in density and vapour pressure is from temperature while most of the uncertainty in viscosity is from the viscosity equation ( $\pm 1.0$  %).

|                                                                                                                                 |                                            |                                          |                |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|------------------------------------------|----------------|
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### 3. SALTWATER PROPERTIES

In the new international standard for seawater properties, IOC, et al. (2010) absolute salinity is mass based. In the previous standard, salinity was practical salinity,  $S_p$ , which is measured as conductivity and has no units. The practical salinity scale is valid over the range,  $2 < S_p < 42$ . For standard seawater, practical salinity has a value of 35 while absolute salinity has a value of  $35.16504 \pm 0.007$  g/kg. Reference salinity is defined as

$$S_R = (35.16504/35)S_p \quad (3)$$

Absolute Salinity may then be computed from a conductivity measurement

$$S_A = S_R + \delta S_A \quad (4)$$

where  $\delta S_A$  is the absolute salinity anomaly. In general, the absolute salinity anomaly is a function of latitude, longitude, and pressure. Additional details are described in IOC, et al. (2010).

#### 3.1 Properties at standard salinity and varying temperature.

Saltwater properties were computed at the standard pressure of 0.101325 MPa and standard absolute salinity,  $S_A = 35.16504 \pm 0.007$  g/kg. The results for density, absolute viscosity, kinematic viscosity, vapour pressure, and their sensitivity coefficients for temperature are presented in Figure 1 through Figure 4. The density was computed from the TEOS-10 code MatLab Version 2, IOC, et al. (2010) while viscosity and vapour pressure were computed from Sharqawy, et al. (2010) from 0.1 to 50 °C in 0.1 °C steps, and the sensitivity coefficients

were computed by the central finite differencing method of Equation (1) with  $\Delta t = 0.1$  °C.

From Sharqawy, et al. (2010) the equation for absolute viscosity is

$$\mu_{sw} = \mu_{fw}(1 + AS_A + BS_A) \quad (5)$$

where

$$A = 1.541 + 0.01998t - 9.52 \times 10^{-5}t^2$$

$$B = 7.974 - 0.07561t + 4.724 \times 10^{-5}t^2$$

The equation for vapour pressure is

$$p_{v, fw} / p_{v, sw} = 1 + 0.57357[S_A / (1000 - S_A)] \quad (6)$$

The fresh water properties (fw) are computed from Harvey, et al. (2008) as described in Section 2. When  $S_A = 0.0$ , the values of vapour pressure and absolute viscosity in Equations (5) and (6) are the same as in Section 2.

Seawater property numerical values at 1 °C increment from 1 to 30 °C are listed in Table 3. A more detailed list at 0.1 °C increments from 0.1 to 50 °C is located in Appendix B.

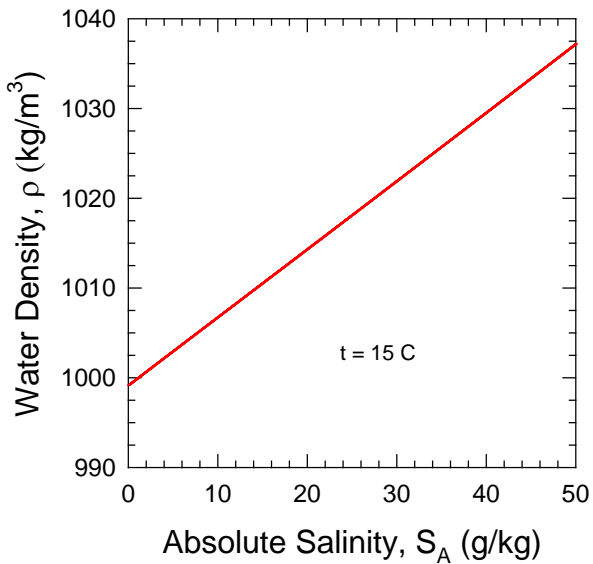
#### 3.2 Properties at 15 °C and varying salinity

As an example and for comparison, results for varying absolute salinity and temperature of 15 °C are presented in Figure 5 through Figure 8 and Table 4. The derivatives of absolute salinity were computed from Equation (1) with  $\Delta S_A = 0.1$  g/kg substituted for temperature.

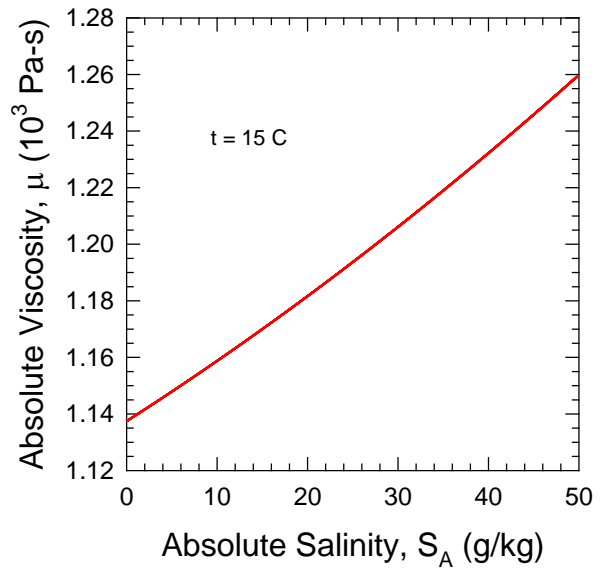
| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 1                | 1028.0941                              | -0.0680                                              | 0.001843               | -6.186E-05                            | 1.7926E-06                              | -6.005E-08                                         | 6.4363E-04              | 4.639E-05                             |
| 2                | 1028.0197                              | -0.0810                                              | 0.001783               | -5.862E-05                            | 1.7341E-06                              | -5.689E-08                                         | 6.9153E-04              | 4.944E-05                             |
| 3                | 1027.9327                              | -0.0930                                              | 0.001726               | -5.561E-05                            | 1.6787E-06                              | -5.395E-08                                         | 7.4256E-04              | 5.265E-05                             |
| 4                | 1027.8336                              | -0.1050                                              | 0.001671               | -5.282E-05                            | 1.6262E-06                              | -5.122E-08                                         | 7.9689E-04              | 5.604E-05                             |
| 5                | 1027.7225                              | -0.1170                                              | 0.001620               | -5.021E-05                            | 1.5762E-06                              | -4.867E-08                                         | 8.5471E-04              | 5.962E-05                             |
| 6                | 1027.6000                              | -0.1280                                              | 0.001571               | -4.777E-05                            | 1.5288E-06                              | -4.630E-08                                         | 9.1620E-04              | 6.340E-05                             |
| 7                | 1027.4662                              | -0.1390                                              | 0.001524               | -4.549E-05                            | 1.4836E-06                              | -4.408E-08                                         | 9.8157E-04              | 6.738E-05                             |
| 8                | 1027.3214                              | -0.1500                                              | 0.001480               | -4.337E-05                            | 1.4406E-06                              | -4.200E-08                                         | 1.0510E-03              | 7.156E-05                             |
| 9                | 1027.1659                              | -0.1605                                              | 0.001438               | -4.137E-05                            | 1.3995E-06                              | -4.006E-08                                         | 1.1248E-03              | 7.597E-05                             |
| 10               | 1027.0000                              | -0.1710                                              | 0.001397               | -3.950E-05                            | 1.3604E-06                              | -3.823E-08                                         | 1.2030E-03              | 8.061E-05                             |
| 11               | 1026.8238                              | -0.1815                                              | 0.001359               | -3.774E-05                            | 1.3230E-06                              | -3.652E-08                                         | 1.2861E-03              | 8.550E-05                             |
| 12               | 1026.6376                              | -0.1915                                              | 0.001322               | -3.609E-05                            | 1.2873E-06                              | -3.492E-08                                         | 1.3741E-03              | 9.063E-05                             |
| 13               | 1026.4416                              | -0.2010                                              | 0.001286               | -3.454E-05                            | 1.2532E-06                              | -3.341E-08                                         | 1.4674E-03              | 9.601E-05                             |
| 14               | 1026.2360                              | -0.2105                                              | 0.001252               | -3.308E-05                            | 1.2205E-06                              | -3.198E-08                                         | 1.5662E-03              | 1.017E-04                             |
| 15               | 1026.0210                              | -0.2195                                              | 0.001220               | -3.170E-05                            | 1.1892E-06                              | -3.064E-08                                         | 1.6709E-03              | 1.076E-04                             |
| 16               | 1025.7967                              | -0.2290                                              | 0.001189               | -3.040E-05                            | 1.1592E-06                              | -2.938E-08                                         | 1.7816E-03              | 1.139E-04                             |
| 17               | 1025.5633                              | -0.2380                                              | 0.001159               | -2.918E-05                            | 1.1304E-06                              | -2.819E-08                                         | 1.8987E-03              | 1.204E-04                             |
| 18               | 1025.3210                              | -0.2470                                              | 0.001131               | -2.801E-05                            | 1.1028E-06                              | -2.706E-08                                         | 2.0225E-03              | 1.272E-04                             |
| 19               | 1025.0700                              | -0.2555                                              | 0.001103               | -2.692E-05                            | 1.0763E-06                              | -2.599E-08                                         | 2.1533E-03              | 1.344E-04                             |
| 20               | 1024.8103                              | -0.2640                                              | 0.001077               | -2.588E-05                            | 1.0508E-06                              | -2.498E-08                                         | 2.2914E-03              | 1.419E-04                             |
| 21               | 1024.5421                              | -0.2725                                              | 0.001051               | -2.489E-05                            | 1.0263E-06                              | -2.402E-08                                         | 2.4373E-03              | 1.498E-04                             |
| 22               | 1024.2656                              | -0.2805                                              | 0.001027               | -2.396E-05                            | 1.0027E-06                              | -2.312E-08                                         | 2.5912E-03              | 1.581E-04                             |
| 23               | 1023.9808                              | -0.2890                                              | 0.001004               | -2.307E-05                            | 9.8002E-07                              | -2.226E-08                                         | 2.7535E-03              | 1.667E-04                             |
| 24               | 1023.6881                              | -0.2970                                              | 0.000981               | -2.223E-05                            | 9.5818E-07                              | -2.144E-08                                         | 2.9247E-03              | 1.757E-04                             |
| 25               | 1023.3873                              | -0.3050                                              | 0.000959               | -2.143E-05                            | 9.3713E-07                              | -2.066E-08                                         | 3.1050E-03              | 1.851E-04                             |
| 26               | 1023.0788                              | -0.3125                                              | 0.000938               | -2.067E-05                            | 9.1683E-07                              | -1.993E-08                                         | 3.2950E-03              | 1.949E-04                             |
| 27               | 1022.7626                              | -0.3200                                              | 0.000918               | -1.995E-05                            | 8.9726E-07                              | -1.922E-08                                         | 3.4950E-03              | 2.052E-04                             |
| 28               | 1022.4389                              | -0.3275                                              | 0.000898               | -1.926E-05                            | 8.7837E-07                              | -1.856E-08                                         | 3.7056E-03              | 2.159E-04                             |
| 29               | 1022.1078                              | -0.3345                                              | 0.000879               | -1.860E-05                            | 8.6014E-07                              | -1.792E-08                                         | 3.9271E-03              | 2.271E-04                             |
| 30               | 1021.7694                              | -0.3420                                              | 0.000861               | -1.798E-05                            | 8.4253E-07                              | -1.731E-08                                         | 4.1600E-03              | 2.388E-04                             |

Table 3: Standard seawater properties at 1 °C increment

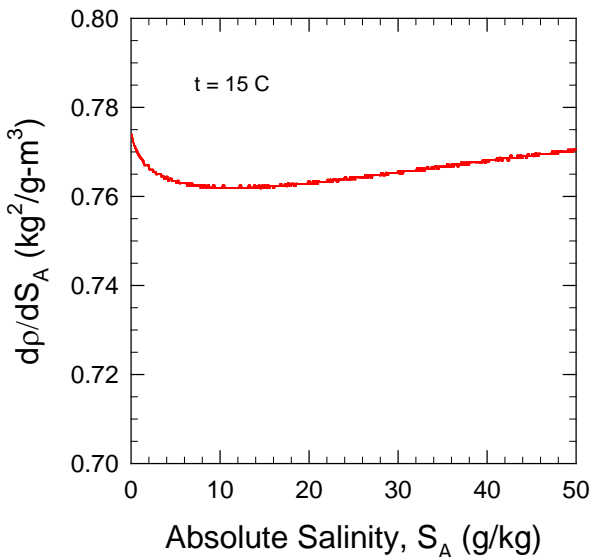




a. Density

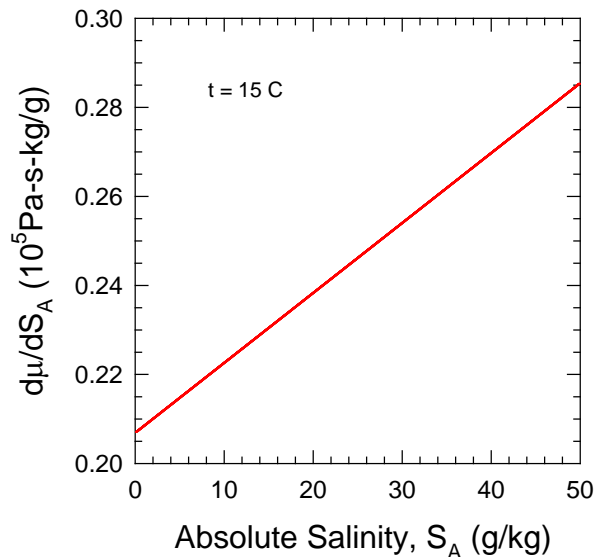


a. Absolute viscosity



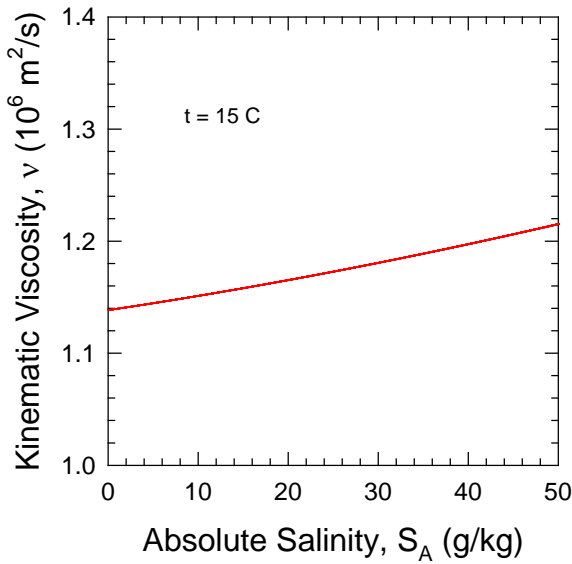
b. Sensitivity coefficient

Figure 5: Seawater density at 15 °C

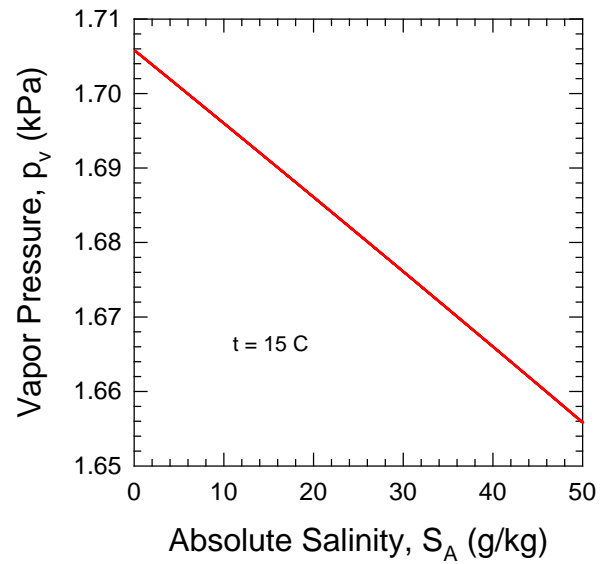


b. Sensitivity coefficient

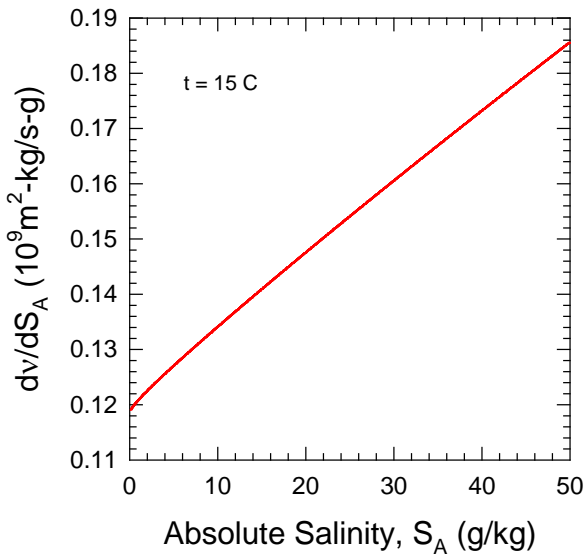
Figure 6: Seawater absolute viscosity at 15 °C



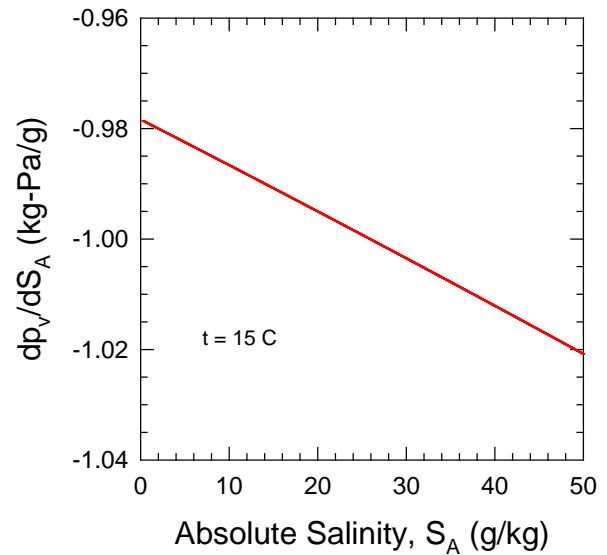
a. Kinematic viscosity



a. Vapour pressure



b. Sensitivity coefficient




b. Sensitivity coefficient

Figure 7: Seawater kinematic viscosity, 15 °C

Figure 8: Seawater vapour pressure at 15 °C

| $S_A$<br>(g/kg) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial S_A$<br>(kg <sup>2</sup> /g·m <sup>3</sup> ) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial S_A$<br>(kg·Pa·s/g) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial S_A$<br>(kg·m <sup>2</sup> /g·s) | Press $p_v$<br>(MPa) | $\partial p_v/\partial S_A$<br>(kg·MPa/g) |
|-----------------|----------------------------------------|---------------------------------------------------------------------|------------------------|-------------------------------------------|-----------------------------------------|--------------------------------------------------------|----------------------|-------------------------------------------|
| 10              | 1006.7950                              | 0.76200                                                             | 0.001159               | 2.228E-06                                 | 1.1512E-06                              | 1.341E-09                                              | 1.6960E-03           | -9.868E-07                                |
| 11              | 1007.5571                              | 0.76200                                                             | 0.001161               | 2.243E-06                                 | 1.1526E-06                              | 1.355E-09                                              | 1.6950E-03           | -9.876E-07                                |
| 12              | 1008.3191                              | 0.76200                                                             | 0.001164               | 2.259E-06                                 | 1.1539E-06                              | 1.369E-09                                              | 1.6940E-03           | -9.885E-07                                |
| 13              | 1009.0812                              | 0.76200                                                             | 0.001166               | 2.275E-06                                 | 1.1553E-06                              | 1.382E-09                                              | 1.6930E-03           | -9.893E-07                                |
| 14              | 1009.8434                              | 0.76200                                                             | 0.001168               | 2.291E-06                                 | 1.1567E-06                              | 1.396E-09                                              | 1.6920E-03           | -9.902E-07                                |
| 15              | 1010.6056                              | 0.76250                                                             | 0.001170               | 2.307E-06                                 | 1.1581E-06                              | 1.409E-09                                              | 1.6910E-03           | -9.910E-07                                |
| 16              | 1011.3680                              | 0.76200                                                             | 0.001173               | 2.322E-06                                 | 1.1595E-06                              | 1.423E-09                                              | 1.6900E-03           | -9.919E-07                                |
| 17              | 1012.1305                              | 0.76250                                                             | 0.001175               | 2.338E-06                                 | 1.1610E-06                              | 1.436E-09                                              | 1.6890E-03           | -9.927E-07                                |
| 18              | 1012.8932                              | 0.76300                                                             | 0.001177               | 2.354E-06                                 | 1.1624E-06                              | 1.448E-09                                              | 1.6880E-03           | -9.936E-07                                |
| 19              | 1013.6561                              | 0.76300                                                             | 0.001180               | 2.370E-06                                 | 1.1638E-06                              | 1.462E-09                                              | 1.6871E-03           | -9.944E-07                                |
| 20              | 1014.4192                              | 0.76350                                                             | 0.001182               | 2.386E-06                                 | 1.1653E-06                              | 1.475E-09                                              | 1.6861E-03           | -9.953E-07                                |
| 21              | 1015.1824                              | 0.76350                                                             | 0.001185               | 2.401E-06                                 | 1.1668E-06                              | 1.488E-09                                              | 1.6851E-03           | -9.962E-07                                |
| 22              | 1015.9459                              | 0.76350                                                             | 0.001187               | 2.417E-06                                 | 1.1683E-06                              | 1.501E-09                                              | 1.6841E-03           | -9.970E-07                                |
| 23              | 1016.7097                              | 0.76400                                                             | 0.001189               | 2.433E-06                                 | 1.1698E-06                              | 1.514E-09                                              | 1.6831E-03           | -9.979E-07                                |
| 24              | 1017.4736                              | 0.76450                                                             | 0.001192               | 2.449E-06                                 | 1.1713E-06                              | 1.527E-09                                              | 1.6821E-03           | -9.987E-07                                |
| 25              | 1018.2379                              | 0.76450                                                             | 0.001194               | 2.465E-06                                 | 1.1729E-06                              | 1.540E-09                                              | 1.6811E-03           | -9.996E-07                                |
| 26              | 1019.0023                              | 0.76450                                                             | 0.001197               | 2.480E-06                                 | 1.1744E-06                              | 1.553E-09                                              | 1.6801E-03           | -1.000E-06                                |
| 27              | 1019.7670                              | 0.76450                                                             | 0.001199               | 2.496E-06                                 | 1.1760E-06                              | 1.566E-09                                              | 1.6791E-03           | -1.001E-06                                |
| 28              | 1020.5320                              | 0.76500                                                             | 0.001202               | 2.512E-06                                 | 1.1775E-06                              | 1.579E-09                                              | 1.6781E-03           | -1.002E-06                                |
| 29              | 1021.2973                              | 0.76550                                                             | 0.001204               | 2.528E-06                                 | 1.1791E-06                              | 1.591E-09                                              | 1.6771E-03           | -1.003E-06                                |
| 30              | 1022.0628                              | 0.76600                                                             | 0.001207               | 2.544E-06                                 | 1.1807E-06                              | 1.604E-09                                              | 1.6761E-03           | -1.004E-06                                |
| 31              | 1022.8286                              | 0.76600                                                             | 0.001209               | 2.559E-06                                 | 1.1823E-06                              | 1.617E-09                                              | 1.6751E-03           | -1.005E-06                                |
| 32              | 1023.5946                              | 0.76600                                                             | 0.001212               | 2.575E-06                                 | 1.1839E-06                              | 1.630E-09                                              | 1.6741E-03           | -1.006E-06                                |
| 33              | 1024.3609                              | 0.76650                                                             | 0.001214               | 2.591E-06                                 | 1.1856E-06                              | 1.642E-09                                              | 1.6730E-03           | -1.007E-06                                |
| 34              | 1025.1275                              | 0.76650                                                             | 0.001217               | 2.607E-06                                 | 1.1872E-06                              | 1.655E-09                                              | 1.6720E-03           | -1.007E-06                                |
| 35              | 1025.8944                              | 0.76700                                                             | 0.001220               | 2.623E-06                                 | 1.1889E-06                              | 1.668E-09                                              | 1.6710E-03           | -1.008E-06                                |
| 36              | 1026.6615                              | 0.76750                                                             | 0.001222               | 2.638E-06                                 | 1.1906E-06                              | 1.680E-09                                              | 1.6700E-03           | -1.009E-06                                |
| 37              | 1027.4289                              | 0.76750                                                             | 0.001225               | 2.654E-06                                 | 1.1923E-06                              | 1.693E-09                                              | 1.6690E-03           | -1.010E-06                                |
| 38              | 1028.1966                              | 0.76800                                                             | 0.001228               | 2.670E-06                                 | 1.1940E-06                              | 1.705E-09                                              | 1.6680E-03           | -1.011E-06                                |
| 39              | 1028.9646                              | 0.76800                                                             | 0.001230               | 2.686E-06                                 | 1.1957E-06                              | 1.718E-09                                              | 1.6670E-03           | -1.012E-06                                |
| 40              | 1029.7328                              | 0.76850                                                             | 0.001233               | 2.702E-06                                 | 1.1974E-06                              | 1.730E-09                                              | 1.6660E-03           | -1.013E-06                                |

Table 4: Seawater properties at 15 °C and 1 g/kg increment of absolute salinity

|                                                                                                                                 |                                            |                                           |                |
|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------|----------------|
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### 3.3 Uncertainty estimates for saltwater properties

The uncertainties in the seawater properties are summarized in Table 5 for an expanded uncertainty with a coverage factor of 2. The uncertainty in density is from IAPWS (2008b) while the uncertainty in vapour pressure and viscosity is from Sharqawy, et al. (2010).

| Property        | Symbol | $U_{95}$ | Units |
|-----------------|--------|----------|-------|
| Density         | $\rho$ | 8        | ppm   |
| Viscosity       | $\mu$  | 1.5      | %     |
| Vapour Pressure | $p_v$  | 0.1      | %     |

Table 5: Uncertainty in seawater properties at 95 % confidence limit

ppm: parts per million (0.0001 %)

The combined uncertainty in this case includes the uncertainty in the equations, absolute salinity and temperature. Equation (2) then becomes

$$U_c = \sqrt{U_x^2 + (c_{x,t}U_t)^2 + (c_{x,S}U_S)^2} \quad (7)$$

where  $c_{x,S} = \partial x / \partial S_A$  is the sensitivity coefficient for salinity. Its value may be obtained from Table 4 at 15 °C; otherwise, the sensitivity coefficients must be computed for a specific absolute salinity and temperature by the methods outlined in this procedure.

#### 3.3.1 Example uncertainty calculation of salt-water properties

For evaluation of full-scale ship performance, standard seawater properties are applied at 15 °C. From the previous section, the following are specific examples of standard seawater properties at 15 °C. From IOC, et al. (2010) the estimated uncertainty in standard absolute salinity is  $\pm 0.007$  g/kg.

For  $U_t = \pm 1.0$  °C:


- Density:  
 $1026.02 \pm 0.22$  kg/m<sup>3</sup> ( $\pm 0.021$  %)
- Absolute viscosity:  
 $0.001220 \pm 0.000037$  Pa·s ( $\pm 3.0$  %)
- Kinematic viscosity:  
 $(1.189 \pm 0.036) \times 10^{-6}$  m<sup>2</sup>/s ( $\pm 3.0$  %)
- Vapour pressure:  
 $1.67 \pm 0.11$  kPa (6.4 %)

In this example, most of the uncertainty is from the uncertainty in temperature.

For  $U_t = \pm 0.10$  °C:

- Density:  
 $1026.021 \pm 0.024$  kg/m<sup>3</sup> ( $\pm 0.0023$  %)
- Absolute viscosity:  
 $0.001220 \pm 0.000019$  Pa·s ( $\pm 1.5$  %)
- Kinematic viscosity:  
 $(1.189 \pm 0.018) \times 10^{-6}$  m<sup>2</sup>/s ( $\pm 1.5$  %)
- Vapour pressure:  
 $1.671 \pm 0.011$  kPa (0.65 %)

In this case, most of the uncertainty in density and vapour pressure is from temperature while most of the uncertainty in viscosity is from the viscosity equation ( $\pm 1.5$  %). The uncertainty estimates are similar to those of fresh water but slightly higher.

|                                                                                   |                                            |                                           |                |
|-----------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------|----------------|
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#### 4. SUMMARY

This procedure outlines some properties of fresh water and seawater from the latest international standards. Examples in this procedure include density, absolute viscosity, kinematic viscosity, and vapour pressure. Other properties are available. The latest fresh water properties are defined by IAWPS (2008a) at standard pressure. The results presented in this procedure are from Harvey, et al. (2008). For conditions other than standard pressure, the properties should be computed from Harvey, et al. (2008). Property data and their sensitivity coefficients are presented for the temperature range of 0.1 to 50 °C and standard pressure.

The latest seawater properties are from IOC, et al. (2010) and IAPWS (2008b). Transport properties are not yet available, and this procedure should be updated when they become available. In the meantime, the transport properties from Sharqawy, et al. (2010) are recommended.

Specific results are presented for standard seawater and standard pressure for the temperature range of 0.1 to 50 °C and for seawater at standard pressure and 15 °C over the absolute salinity range of 10 to 40 g/kg. For other conditions, the recommended computer codes should be applied on the basis of this procedure. For example, the seawater properties in the prediction of submarine performance should be determined from conditions at operating depth such as temperature, pressure, and salinity.

Fresh water property data were provided at the standard laboratory temperature of 20 °C and standard pressure. Example uncertainty estimates are provided for an uncertainty in

temperature of  $\pm 1.0$  and  $\pm 0.10$  °C. Similarly seawater properties were provided for the standard at sea temperature of 15 °C, standard absolute salinity, and standard pressure. Uncertainty estimates in the properties were also provided for an uncertainty in temperature at  $\pm 1.0$  and  $\pm 0.10$  °C. The uncertainty estimates were similar to those for fresh water but slightly higher. For both fresh water and saltwater, the dominant term in the uncertainty estimate is temperature at an uncertainty in temperature of  $\pm 1.0$  °C while at  $\pm 0.10$  °C uncertainty the uncertainty in the equation is dominant for viscosity.

For fresh water, application of Harvey, et al. (2008) is recommended rather than IOC, et al. (2010) at  $S_A = 0.0$ . At 25 °C, the values from Harvey, et al. (2008) are in agreement with the check values in Table 8 of IAWPS (2008a) for density and viscosity. However, a slight discrepancy exists for standard seawater and fresh water in Table 8 at 0 °C of IAWPS (2008b) in comparison with the MatLab code version 2 from IOC, et al. (2010). The value of fresh water density differs by 52 ppm, and seawater by 47 ppm, when the stated uncertainty in the equations is 8 ppm. The fresh water check value at 0 °C from IAPWS (2008b) does agree with the value from Harvey, et al. (2008). However, the discrepancy is still small in comparison to the uncertainty contribution from temperature. In general, future international developments in seawater properties for TEOS-10 and IAWPS should be monitored and adopted.

Finally, seawater properties are provided in the following figures, Figure 9 through Figure 12, as functions of both absolute salinity and temperature in increments of 1 °C in temperature and 1 g/kg for absolute salinity as three-

dimensional plots. These results are at one standard atmosphere, 0.101325 MPa.

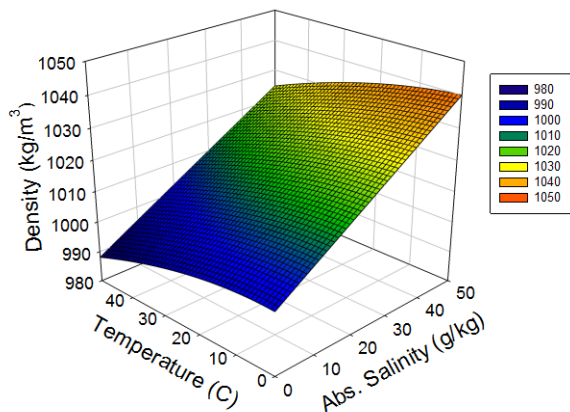


Figure 9: Seawater density

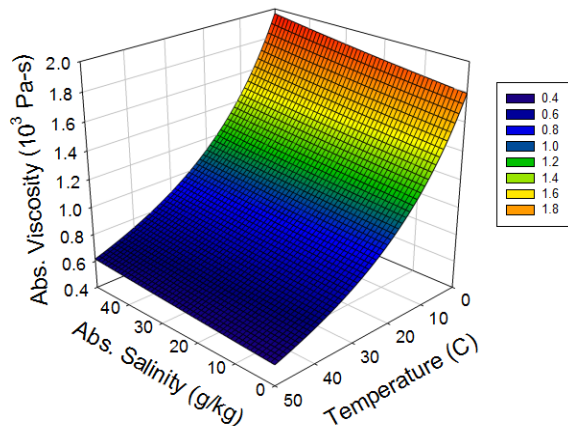


Figure 10: Seawater absolute viscosity

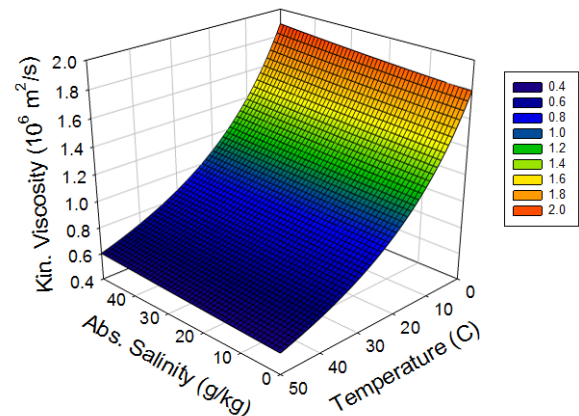


Figure 11: Seawater kinematic viscosity

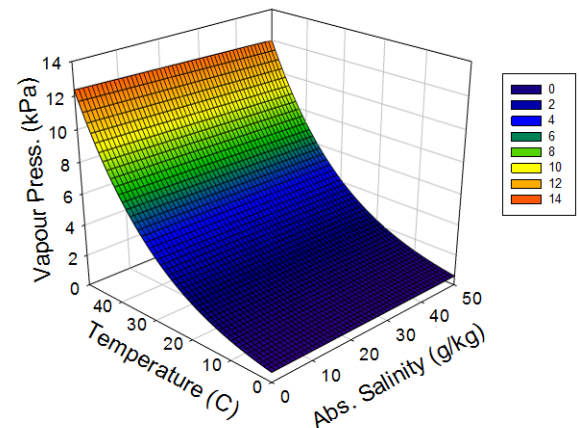



Figure 12: Seawater vapour pressure

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|                                                                                                                                 |                                            |                                           |                |
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## 6. LIST OF SYMBOLS

|        |                                       |                   |
|--------|---------------------------------------|-------------------|
| $k$    | Coverage factor, usually $k = 2$      |                   |
| $p$    | Pressure                              | MPa               |
| $p_v$  | Vapour pressure                       | MPa               |
| $S_A$  | Absolute salinity                     | g/kg              |
| $S_P$  | Practical salinity                    | 1                 |
| $S_R$  | Reference salinity                    | g/kg              |
| $t$    | Water temperature                     | °C                |
| $u_c$  | Combined standard uncertainty         |                   |
| $U$    | Expanded uncertainty, $U = ku_c$      |                   |
| $\mu$  | Absolute viscosity                    | kg/(m·s) or Pa·s  |
| $\nu$  | Kinematic viscosity, $\nu = \mu/\rho$ | m <sup>2</sup> /s |
| $\rho$ | Water density                         | kg/m <sup>3</sup> |

**Appendix A: Fresh Water Properties 0.1 to 50 °C in 0.1 °C Increments**

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 0.1              | 999.8498                               | 0.06593                                              | 0.001786                  |                                       | 1.7858E-06                              |                                                    | 6.1567E-04              |                                       |
| 0.2              | 999.8563                               | 0.06412                                              | 0.001779                  | -6.174E-05                            | 1.7796E-06                              | -6.186E-08                                         | 6.2015E-04              | 4.499E-05                             |
| 0.3              | 999.8626                               | 0.06232                                              | 0.001773                  | -6.140E-05                            | 1.7734E-06                              | -6.152E-08                                         | 6.2467E-04              | 4.528E-05                             |
| 0.4              | 999.8687                               | 0.06052                                              | 0.001767                  | -6.106E-05                            | 1.7673E-06                              | -6.118E-08                                         | 6.2921E-04              | 4.557E-05                             |
| 0.5              | 999.8747                               | 0.05873                                              | 0.001761                  | -6.072E-05                            | 1.7612E-06                              | -6.084E-08                                         | 6.3378E-04              | 4.587E-05                             |
| 0.6              | 999.8805                               | 0.05694                                              | 0.001755                  | -6.039E-05                            | 1.7551E-06                              | -6.050E-08                                         | 6.3838E-04              | 4.616E-05                             |
| 0.7              | 999.8861                               | 0.05516                                              | 0.001749                  | -6.006E-05                            | 1.7491E-06                              | -6.016E-08                                         | 6.4301E-04              | 4.646E-05                             |
| 0.8              | 999.8915                               | 0.05339                                              | 0.001743                  | -5.973E-05                            | 1.7431E-06                              | -5.983E-08                                         | 6.4767E-04              | 4.676E-05                             |
| 0.9              | 999.8968                               | 0.05162                                              | 0.001737                  | -5.940E-05                            | 1.7371E-06                              | -5.950E-08                                         | 6.5236E-04              | 4.706E-05                             |
| 1.0              | 999.9018                               | 0.04986                                              | 0.001731                  | -5.908E-05                            | 1.7312E-06                              | -5.917E-08                                         | 6.5709E-04              | 4.736E-05                             |
| 1.1              | 999.9067                               | 0.04810                                              | 0.001725                  | -5.876E-05                            | 1.7253E-06                              | -5.885E-08                                         | 6.6184E-04              | 4.766E-05                             |
| 1.2              | 999.9115                               | 0.04635                                              | 0.001719                  | -5.844E-05                            | 1.7194E-06                              | -5.852E-08                                         | 6.6662E-04              | 4.797E-05                             |
| 1.3              | 999.9160                               | 0.04461                                              | 0.001713                  | -5.812E-05                            | 1.7136E-06                              | -5.820E-08                                         | 6.7143E-04              | 4.828E-05                             |
| 1.4              | 999.9204                               | 0.04287                                              | 0.001708                  | -5.781E-05                            | 1.7078E-06                              | -5.789E-08                                         | 6.7627E-04              | 4.858E-05                             |
| 1.5              | 999.9246                               | 0.04114                                              | 0.001702                  | -5.750E-05                            | 1.7020E-06                              | -5.757E-08                                         | 6.8115E-04              | 4.889E-05                             |
| 1.6              | 999.9286                               | 0.03942                                              | 0.001696                  | -5.719E-05                            | 1.6963E-06                              | -5.726E-08                                         | 6.8605E-04              | 4.921E-05                             |
| 1.7              | 999.9325                               | 0.03770                                              | 0.001690                  | -5.688E-05                            | 1.6906E-06                              | -5.695E-08                                         | 6.9099E-04              | 4.952E-05                             |
| 1.8              | 999.9362                               | 0.03598                                              | 0.001685                  | -5.657E-05                            | 1.6849E-06                              | -5.664E-08                                         | 6.9596E-04              | 4.983E-05                             |
| 1.9              | 999.9397                               | 0.03427                                              | 0.001679                  | -5.627E-05                            | 1.6792E-06                              | -5.633E-08                                         | 7.0095E-04              | 5.015E-05                             |
| 2.0              | 999.9430                               | 0.03257                                              | 0.001674                  | -5.597E-05                            | 1.6736E-06                              | -5.603E-08                                         | 7.0599E-04              | 5.047E-05                             |
| 2.1              | 999.9462                               | 0.03087                                              | 0.001668                  | -5.567E-05                            | 1.6680E-06                              | -5.573E-08                                         | 7.1105E-04              | 5.079E-05                             |
| 2.2              | 999.9492                               | 0.02918                                              | 0.001662                  | -5.538E-05                            | 1.6625E-06                              | -5.543E-08                                         | 7.1614E-04              | 5.111E-05                             |
| 2.3              | 999.9520                               | 0.02749                                              | 0.001657                  | -5.508E-05                            | 1.6569E-06                              | -5.513E-08                                         | 7.2127E-04              | 5.144E-05                             |
| 2.4              | 999.9547                               | 0.02581                                              | 0.001651                  | -5.479E-05                            | 1.6514E-06                              | -5.483E-08                                         | 7.2643E-04              | 5.176E-05                             |
| 2.5              | 999.9572                               | 0.02414                                              | 0.001646                  | -5.450E-05                            | 1.6460E-06                              | -5.454E-08                                         | 7.3162E-04              | 5.209E-05                             |
| 2.6              | 999.9595                               | 0.02247                                              | 0.001640                  | -5.421E-05                            | 1.6405E-06                              | -5.425E-08                                         | 7.3685E-04              | 5.242E-05                             |
| 2.7              | 999.9617                               | 0.02080                                              | 0.001635                  | -5.392E-05                            | 1.6351E-06                              | -5.396E-08                                         | 7.4211E-04              | 5.275E-05                             |
| 2.8              | 999.9637                               | 0.01915                                              | 0.001630                  | -5.364E-05                            | 1.6297E-06                              | -5.367E-08                                         | 7.4740E-04              | 5.308E-05                             |
| 2.9              | 999.9655                               | 0.01749                                              | 0.001624                  | -5.336E-05                            | 1.6244E-06                              | -5.339E-08                                         | 7.5272E-04              | 5.342E-05                             |
| 3.0              | 999.9672                               | 0.01584                                              | 0.001619                  | -5.308E-05                            | 1.6191E-06                              | -5.311E-08                                         | 7.5808E-04              | 5.375E-05                             |
| 3.1              | 999.9687                               | 0.01420                                              | 0.001614                  | -5.280E-05                            | 1.6138E-06                              | -5.283E-08                                         | 7.6347E-04              | 5.409E-05                             |
| 3.2              | 999.9700                               | 0.01256                                              | 0.001608                  | -5.253E-05                            | 1.6085E-06                              | -5.255E-08                                         | 7.6890E-04              | 5.443E-05                             |
| 3.3              | 999.9712                               | 0.01093                                              | 0.001603                  | -5.225E-05                            | 1.6033E-06                              | -5.227E-08                                         | 7.7436E-04              | 5.477E-05                             |



| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 3.4              | 999.9722                               | 0.00931                                              | 0.001598                  | -5.198E-05                            | 1.5980E-06                              | -5.200E-08                                         | 7.7985E-04              | 5.511E-05                             |
| 3.5              | 999.9730                               | 0.00768                                              | 0.001593                  | -5.171E-05                            | 1.5929E-06                              | -5.172E-08                                         | 7.8538E-04              | 5.546E-05                             |
| 3.6              | 999.9737                               | 0.00607                                              | 0.001588                  | -5.144E-05                            | 1.5877E-06                              | -5.145E-08                                         | 7.9094E-04              | 5.581E-05                             |
| 3.7              | 999.9743                               | 0.00446                                              | 0.001583                  | -5.118E-05                            | 1.5826E-06                              | -5.118E-08                                         | 7.9654E-04              | 5.616E-05                             |
| 3.8              | 999.9746                               | 0.00285                                              | 0.001577                  | -5.091E-05                            | 1.5775E-06                              | -5.092E-08                                         | 8.0218E-04              | 5.651E-05                             |
| 3.9              | 999.9748                               | 0.00125                                              | 0.001572                  | -5.065E-05                            | 1.5724E-06                              | -5.065E-08                                         | 8.0784E-04              | 5.686E-05                             |
| 4.0              | 999.9749                               | -0.00035                                             | 0.001567                  | -5.039E-05                            | 1.5673E-06                              | -5.039E-08                                         | 8.1355E-04              | 5.722E-05                             |
| 4.1              | 999.9748                               | -0.00194                                             | 0.001562                  | -5.013E-05                            | 1.5623E-06                              | -5.013E-08                                         | 8.1929E-04              | 5.757E-05                             |
| 4.2              | 999.9745                               | -0.00353                                             | 0.001557                  | -4.987E-05                            | 1.5573E-06                              | -4.987E-08                                         | 8.2506E-04              | 5.793E-05                             |
| 4.3              | 999.9741                               | -0.00511                                             | 0.001552                  | -4.962E-05                            | 1.5523E-06                              | -4.961E-08                                         | 8.3087E-04              | 5.829E-05                             |
| 4.4              | 999.9735                               | -0.00668                                             | 0.001547                  | -4.936E-05                            | 1.5474E-06                              | -4.935E-08                                         | 8.3672E-04              | 5.865E-05                             |
| 4.5              | 999.9727                               | -0.00826                                             | 0.001542                  | -4.911E-05                            | 1.5425E-06                              | -4.910E-08                                         | 8.4260E-04              | 5.902E-05                             |
| 4.6              | 999.9718                               | -0.00982                                             | 0.001538                  | -4.886E-05                            | 1.5376E-06                              | -4.885E-08                                         | 8.4853E-04              | 5.939E-05                             |
| 4.7              | 999.9708                               | -0.01138                                             | 0.001533                  | -4.861E-05                            | 1.5327E-06                              | -4.860E-08                                         | 8.5448E-04              | 5.975E-05                             |
| 4.8              | 999.9695                               | -0.01294                                             | 0.001528                  | -4.837E-05                            | 1.5278E-06                              | -4.835E-08                                         | 8.6048E-04              | 6.012E-05                             |
| 4.9              | 999.9682                               | -0.01449                                             | 0.001523                  | -4.812E-05                            | 1.5230E-06                              | -4.810E-08                                         | 8.6651E-04              | 6.050E-05                             |
| 5.0              | 999.9666                               | -0.01604                                             | 0.001518                  | -4.788E-05                            | 1.5182E-06                              | -4.786E-08                                         | 8.7258E-04              | 6.087E-05                             |
| 5.1              | 999.9650                               | -0.01758                                             | 0.001513                  | -4.764E-05                            | 1.5135E-06                              | -4.761E-08                                         | 8.7868E-04              | 6.125E-05                             |
| 5.2              | 999.9631                               | -0.01912                                             | 0.001509                  | -4.740E-05                            | 1.5087E-06                              | -4.737E-08                                         | 8.8482E-04              | 6.163E-05                             |
| 5.3              | 999.9611                               | -0.02066                                             | 0.001504                  | -4.716E-05                            | 1.5040E-06                              | -4.713E-08                                         | 8.9101E-04              | 6.201E-05                             |
| 5.4              | 999.9590                               | -0.02218                                             | 0.001499                  | -4.692E-05                            | 1.4993E-06                              | -4.689E-08                                         | 8.9723E-04              | 6.239E-05                             |
| 5.5              | 999.9567                               | -0.02371                                             | 0.001495                  | -4.669E-05                            | 1.4946E-06                              | -4.666E-08                                         | 9.0348E-04              | 6.277E-05                             |
| 5.6              | 999.9542                               | -0.02523                                             | 0.001490                  | -4.646E-05                            | 1.4899E-06                              | -4.642E-08                                         | 9.0978E-04              | 6.316E-05                             |
| 5.7              | 999.9517                               | -0.02674                                             | 0.001485                  | -4.622E-05                            | 1.4853E-06                              | -4.619E-08                                         | 9.1612E-04              | 6.355E-05                             |
| 5.8              | 999.9489                               | -0.02825                                             | 0.001481                  | -4.599E-05                            | 1.4807E-06                              | -4.596E-08                                         | 9.2249E-04              | 6.394E-05                             |
| 5.9              | 999.9460                               | -0.02976                                             | 0.001476                  | -4.577E-05                            | 1.4761E-06                              | -4.572E-08                                         | 9.2890E-04              | 6.433E-05                             |
| 6.0              | 999.9429                               | -0.03126                                             | 0.001471                  | -4.554E-05                            | 1.4716E-06                              | -4.550E-08                                         | 9.3536E-04              | 6.472E-05                             |
| 6.1              | 999.9397                               | -0.03276                                             | 0.001467                  | -4.531E-05                            | 1.4670E-06                              | -4.527E-08                                         | 9.4185E-04              | 6.512E-05                             |
| 6.2              | 999.9364                               | -0.03425                                             | 0.001462                  | -4.509E-05                            | 1.4625E-06                              | -4.504E-08                                         | 9.4838E-04              | 6.552E-05                             |
| 6.3              | 999.9329                               | -0.03574                                             | 0.001458                  | -4.487E-05                            | 1.4580E-06                              | -4.482E-08                                         | 9.5495E-04              | 6.592E-05                             |
| 6.4              | 999.9292                               | -0.03722                                             | 0.001453                  | -4.465E-05                            | 1.4535E-06                              | -4.460E-08                                         | 9.6156E-04              | 6.632E-05                             |
| 6.5              | 999.9255                               | -0.03870                                             | 0.001449                  | -4.443E-05                            | 1.4491E-06                              | -4.437E-08                                         | 9.6822E-04              | 6.673E-05                             |
| 6.6              | 999.9215                               | -0.04018                                             | 0.001445                  | -4.421E-05                            | 1.4447E-06                              | -4.416E-08                                         | 9.7491E-04              | 6.713E-05                             |
| 6.7              | 999.9174                               | -0.04165                                             | 0.001440                  | -4.399E-05                            | 1.4403E-06                              | -4.394E-08                                         | 9.8164E-04              | 6.754E-05                             |
| 6.8              | 999.9132                               | -0.04311                                             | 0.001436                  | -4.378E-05                            | 1.4359E-06                              | -4.372E-08                                         | 9.8842E-04              | 6.796E-05                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 6.9              | 999.9088                               | -0.04458                                             | 0.001431                  | -4.357E-05                            | 1.4315E-06                              | -4.351E-08                                         | 9.9523E-04              | 6.837E-05                             |
| 7.0              | 999.9043                               | -0.04603                                             | 0.001427                  | -4.335E-05                            | 1.4272E-06                              | -4.329E-08                                         | 1.0021E-03              | 6.878E-05                             |
| 7.1              | 999.8996                               | -0.04749                                             | 0.001423                  | -4.314E-05                            | 1.4229E-06                              | -4.308E-08                                         | 1.0090E-03              | 6.920E-05                             |
| 7.2              | 999.8948                               | -0.04894                                             | 0.001418                  | -4.293E-05                            | 1.4186E-06                              | -4.287E-08                                         | 1.0159E-03              | 6.962E-05                             |
| 7.3              | 999.8898                               | -0.05038                                             | 0.001414                  | -4.273E-05                            | 1.4143E-06                              | -4.266E-08                                         | 1.0229E-03              | 7.004E-05                             |
| 7.4              | 999.8847                               | -0.05182                                             | 0.001410                  | -4.252E-05                            | 1.4100E-06                              | -4.245E-08                                         | 1.0299E-03              | 7.047E-05                             |
| 7.5              | 999.8794                               | -0.05326                                             | 0.001406                  | -4.231E-05                            | 1.4058E-06                              | -4.224E-08                                         | 1.0370E-03              | 7.090E-05                             |
| 7.6              | 999.8740                               | -0.05469                                             | 0.001401                  | -4.211E-05                            | 1.4016E-06                              | -4.204E-08                                         | 1.0441E-03              | 7.132E-05                             |
| 7.7              | 999.8685                               | -0.05612                                             | 0.001397                  | -4.191E-05                            | 1.3974E-06                              | -4.183E-08                                         | 1.0513E-03              | 7.175E-05                             |
| 7.8              | 999.8628                               | -0.05755                                             | 0.001393                  | -4.171E-05                            | 1.3932E-06                              | -4.163E-08                                         | 1.0585E-03              | 7.219E-05                             |
| 7.9              | 999.8570                               | -0.05897                                             | 0.001389                  | -4.151E-05                            | 1.3891E-06                              | -4.143E-08                                         | 1.0657E-03              | 7.262E-05                             |
| 8.0              | 999.8510                               | -0.06039                                             | 0.001385                  | -4.131E-05                            | 1.3849E-06                              | -4.123E-08                                         | 1.0730E-03              | 7.306E-05                             |
| 8.1              | 999.8449                               | -0.06180                                             | 0.001381                  | -4.111E-05                            | 1.3808E-06                              | -4.103E-08                                         | 1.0803E-03              | 7.350E-05                             |
| 8.2              | 999.8387                               | -0.06321                                             | 0.001377                  | -4.092E-05                            | 1.3767E-06                              | -4.083E-08                                         | 1.0877E-03              | 7.394E-05                             |
| 8.3              | 999.8323                               | -0.06461                                             | 0.001372                  | -4.072E-05                            | 1.3727E-06                              | -4.064E-08                                         | 1.0951E-03              | 7.439E-05                             |
| 8.4              | 999.8257                               | -0.06601                                             | 0.001368                  | -4.053E-05                            | 1.3686E-06                              | -4.044E-08                                         | 1.1026E-03              | 7.483E-05                             |
| 8.5              | 999.8191                               | -0.06741                                             | 0.001364                  | -4.033E-05                            | 1.3646E-06                              | -4.025E-08                                         | 1.1101E-03              | 7.528E-05                             |
| 8.6              | 999.8123                               | -0.06880                                             | 0.001360                  | -4.014E-05                            | 1.3605E-06                              | -4.006E-08                                         | 1.1176E-03              | 7.574E-05                             |
| 8.7              | 999.8053                               | -0.07019                                             | 0.001356                  | -3.995E-05                            | 1.3566E-06                              | -3.987E-08                                         | 1.1252E-03              | 7.619E-05                             |
| 8.8              | 999.7982                               | -0.07158                                             | 0.001352                  | -3.977E-05                            | 1.3526E-06                              | -3.968E-08                                         | 1.1329E-03              | 7.664E-05                             |
| 8.9              | 999.7910                               | -0.07296                                             | 0.001348                  | -3.958E-05                            | 1.3486E-06                              | -3.949E-08                                         | 1.1406E-03              | 7.710E-05                             |
| 9.0              | 999.7836                               | -0.07434                                             | 0.001344                  | -3.939E-05                            | 1.3447E-06                              | -3.930E-08                                         | 1.1483E-03              | 7.756E-05                             |
| 9.1              | 999.7761                               | -0.07571                                             | 0.001340                  | -3.921E-05                            | 1.3408E-06                              | -3.911E-08                                         | 1.1561E-03              | 7.803E-05                             |
| 9.2              | 999.7685                               | -0.07708                                             | 0.001337                  | -3.902E-05                            | 1.3369E-06                              | -3.893E-08                                         | 1.1639E-03              | 7.849E-05                             |
| 9.3              | 999.7607                               | -0.07845                                             | 0.001333                  | -3.884E-05                            | 1.3330E-06                              | -3.875E-08                                         | 1.1718E-03              | 7.896E-05                             |
| 9.4              | 999.7528                               | -0.07981                                             | 0.001329                  | -3.866E-05                            | 1.3291E-06                              | -3.856E-08                                         | 1.1797E-03              | 7.943E-05                             |
| 9.5              | 999.7447                               | -0.08117                                             | 0.001325                  | -3.848E-05                            | 1.3253E-06                              | -3.838E-08                                         | 1.1877E-03              | 7.990E-05                             |
| 9.6              | 999.7366                               | -0.08252                                             | 0.001321                  | -3.830E-05                            | 1.3214E-06                              | -3.820E-08                                         | 1.1957E-03              | 8.038E-05                             |
| 9.7              | 999.7282                               | -0.08387                                             | 0.001317                  | -3.812E-05                            | 1.3176E-06                              | -3.802E-08                                         | 1.2037E-03              | 8.085E-05                             |
| 9.8              | 999.7198                               | -0.08522                                             | 0.001313                  | -3.795E-05                            | 1.3138E-06                              | -3.785E-08                                         | 1.2118E-03              | 8.133E-05                             |
| 9.9              | 999.7112                               | -0.08657                                             | 0.001310                  | -3.777E-05                            | 1.3100E-06                              | -3.767E-08                                         | 1.2200E-03              | 8.182E-05                             |
| 10.0             | 999.7025                               | -0.08791                                             | 0.001306                  | -3.760E-05                            | 1.3063E-06                              | -3.749E-08                                         | 1.2282E-03              | 8.230E-05                             |
| 10.1             | 999.6936                               | -0.08924                                             | 0.001302                  | -3.742E-05                            | 1.3025E-06                              | -3.732E-08                                         | 1.2365E-03              | 8.279E-05                             |
| 10.2             | 999.6846                               | -0.09058                                             | 0.001298                  | -3.725E-05                            | 1.2988E-06                              | -3.715E-08                                         | 1.2448E-03              | 8.328E-05                             |
| 10.3             | 999.6755                               | -0.09191                                             | 0.001295                  | -3.708E-05                            | 1.2951E-06                              | -3.697E-08                                         | 1.2531E-03              | 8.377E-05                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 10.4             | 999.6662                               | -0.09323                                             | 0.001291                  | -3.691E-05                            | 1.2914E-06                              | -3.680E-08                                         | 1.2615E-03              | 8.426E-05                             |
| 10.5             | 999.6569                               | -0.09456                                             | 0.001287                  | -3.674E-05                            | 1.2878E-06                              | -3.663E-08                                         | 1.2700E-03              | 8.476E-05                             |
| 10.6             | 999.6473                               | -0.09588                                             | 0.001284                  | -3.657E-05                            | 1.2841E-06                              | -3.646E-08                                         | 1.2785E-03              | 8.526E-05                             |
| 10.7             | 999.6377                               | -0.09719                                             | 0.001280                  | -3.641E-05                            | 1.2805E-06                              | -3.629E-08                                         | 1.2870E-03              | 8.576E-05                             |
| 10.8             | 999.6279                               | -0.09850                                             | 0.001276                  | -3.624E-05                            | 1.2768E-06                              | -3.613E-08                                         | 1.2956E-03              | 8.627E-05                             |
| 10.9             | 999.6180                               | -0.09981                                             | 0.001273                  | -3.608E-05                            | 1.2732E-06                              | -3.596E-08                                         | 1.3043E-03              | 8.677E-05                             |
| 11.0             | 999.6079                               | -0.10112                                             | 0.001269                  | -3.591E-05                            | 1.2697E-06                              | -3.580E-08                                         | 1.3130E-03              | 8.728E-05                             |
| 11.1             | 999.5978                               | -0.10242                                             | 0.001266                  | -3.575E-05                            | 1.2661E-06                              | -3.563E-08                                         | 1.3217E-03              | 8.779E-05                             |
| 11.2             | 999.5874                               | -0.10372                                             | 0.001262                  | -3.559E-05                            | 1.2625E-06                              | -3.547E-08                                         | 1.3305E-03              | 8.831E-05                             |
| 11.3             | 999.5770                               | -0.10502                                             | 0.001258                  | -3.543E-05                            | 1.2590E-06                              | -3.531E-08                                         | 1.3394E-03              | 8.883E-05                             |
| 11.4             | 999.5664                               | -0.10631                                             | 0.001255                  | -3.527E-05                            | 1.2555E-06                              | -3.515E-08                                         | 1.3483E-03              | 8.935E-05                             |
| 11.5             | 999.5558                               | -0.10760                                             | 0.001251                  | -3.511E-05                            | 1.2520E-06                              | -3.499E-08                                         | 1.3573E-03              | 8.987E-05                             |
| 11.6             | 999.5449                               | -0.10888                                             | 0.001248                  | -3.495E-05                            | 1.2485E-06                              | -3.483E-08                                         | 1.3663E-03              | 9.039E-05                             |
| 11.7             | 999.5340                               | -0.11016                                             | 0.001244                  | -3.479E-05                            | 1.2450E-06                              | -3.467E-08                                         | 1.3753E-03              | 9.092E-05                             |
| 11.8             | 999.5229                               | -0.11144                                             | 0.001241                  | -3.464E-05                            | 1.2415E-06                              | -3.452E-08                                         | 1.3845E-03              | 9.145E-05                             |
| 11.9             | 999.5117                               | -0.11272                                             | 0.001237                  | -3.448E-05                            | 1.2381E-06                              | -3.436E-08                                         | 1.3936E-03              | 9.198E-05                             |
| 12.0             | 999.5004                               | -0.11399                                             | 0.001234                  | -3.433E-05                            | 1.2347E-06                              | -3.420E-08                                         | 1.4028E-03              | 9.252E-05                             |
| 12.1             | 999.4889                               | -0.11526                                             | 0.001231                  | -3.417E-05                            | 1.2312E-06                              | -3.405E-08                                         | 1.4121E-03              | 9.306E-05                             |
| 12.2             | 999.4773                               | -0.11652                                             | 0.001227                  | -3.402E-05                            | 1.2279E-06                              | -3.390E-08                                         | 1.4215E-03              | 9.360E-05                             |
| 12.3             | 999.4656                               | -0.11779                                             | 0.001224                  | -3.387E-05                            | 1.2245E-06                              | -3.375E-08                                         | 1.4308E-03              | 9.414E-05                             |
| 12.4             | 999.4537                               | -0.11904                                             | 0.001220                  | -3.372E-05                            | 1.2211E-06                              | -3.359E-08                                         | 1.4403E-03              | 9.469E-05                             |
| 12.5             | 999.4418                               | -0.12030                                             | 0.001217                  | -3.357E-05                            | 1.2177E-06                              | -3.344E-08                                         | 1.4498E-03              | 9.524E-05                             |
| 12.6             | 999.4297                               | -0.12155                                             | 0.001214                  | -3.342E-05                            | 1.2144E-06                              | -3.329E-08                                         | 1.4593E-03              | 9.579E-05                             |
| 12.7             | 999.4175                               | -0.12280                                             | 0.001210                  | -3.328E-05                            | 1.2111E-06                              | -3.315E-08                                         | 1.4689E-03              | 9.634E-05                             |
| 12.8             | 999.4051                               | -0.12405                                             | 0.001207                  | -3.313E-05                            | 1.2078E-06                              | -3.300E-08                                         | 1.4786E-03              | 9.690E-05                             |
| 12.9             | 999.3927                               | -0.12529                                             | 0.001204                  | -3.298E-05                            | 1.2045E-06                              | -3.285E-08                                         | 1.4883E-03              | 9.746E-05                             |
| 13.0             | 999.3801                               | -0.12653                                             | 0.001200                  | -3.284E-05                            | 1.2012E-06                              | -3.271E-08                                         | 1.4981E-03              | 9.802E-05                             |
| 13.1             | 999.3673                               | -0.12777                                             | 0.001197                  | -3.269E-05                            | 1.1979E-06                              | -3.256E-08                                         | 1.5079E-03              | 9.859E-05                             |
| 13.2             | 999.3545                               | -0.12900                                             | 0.001194                  | -3.255E-05                            | 1.1947E-06                              | -3.242E-08                                         | 1.5178E-03              | 9.916E-05                             |
| 13.3             | 999.3415                               | -0.13024                                             | 0.001191                  | -3.241E-05                            | 1.1915E-06                              | -3.228E-08                                         | 1.5278E-03              | 9.973E-05                             |
| 13.4             | 999.3285                               | -0.13146                                             | 0.001187                  | -3.227E-05                            | 1.1882E-06                              | -3.213E-08                                         | 1.5378E-03              | 1.003E-04                             |
| 13.5             | 999.3153                               | -0.13269                                             | 0.001184                  | -3.213E-05                            | 1.1850E-06                              | -3.199E-08                                         | 1.5478E-03              | 1.009E-04                             |
| 13.6             | 999.3019                               | -0.13391                                             | 0.001181                  | -3.199E-05                            | 1.1818E-06                              | -3.185E-08                                         | 1.5579E-03              | 1.015E-04                             |
| 13.7             | 999.2885                               | -0.13513                                             | 0.001178                  | -3.185E-05                            | 1.1787E-06                              | -3.171E-08                                         | 1.5681E-03              | 1.020E-04                             |
| 13.8             | 999.2749                               | -0.13634                                             | 0.001175                  | -3.171E-05                            | 1.1755E-06                              | -3.157E-08                                         | 1.5783E-03              | 1.026E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 13.9             | 999.2612                               | -0.13756                                             | 0.001171                  | -3.157E-05                            | 1.1724E-06                              | -3.144E-08                                         | 1.5886E-03              | 1.032E-04                             |
| 14.0             | 999.2474                               | -0.13877                                             | 0.001168                  | -3.144E-05                            | 1.1692E-06                              | -3.130E-08                                         | 1.5990E-03              | 1.038E-04                             |
| 14.1             | 999.2335                               | -0.13997                                             | 0.001165                  | -3.130E-05                            | 1.1661E-06                              | -3.116E-08                                         | 1.6094E-03              | 1.044E-04                             |
| 14.2             | 999.2194                               | -0.14118                                             | 0.001162                  | -3.117E-05                            | 1.1630E-06                              | -3.103E-08                                         | 1.6199E-03              | 1.050E-04                             |
| 14.3             | 999.2052                               | -0.14238                                             | 0.001159                  | -3.103E-05                            | 1.1599E-06                              | -3.089E-08                                         | 1.6304E-03              | 1.056E-04                             |
| 14.4             | 999.1909                               | -0.14358                                             | 0.001156                  | -3.090E-05                            | 1.1568E-06                              | -3.076E-08                                         | 1.6410E-03              | 1.062E-04                             |
| 14.5             | 999.1765                               | -0.14477                                             | 0.001153                  | -3.077E-05                            | 1.1537E-06                              | -3.062E-08                                         | 1.6516E-03              | 1.068E-04                             |
| 14.6             | 999.1620                               | -0.14597                                             | 0.001150                  | -3.064E-05                            | 1.1507E-06                              | -3.049E-08                                         | 1.6623E-03              | 1.074E-04                             |
| 14.7             | 999.1473                               | -0.14716                                             | 0.001147                  | -3.050E-05                            | 1.1476E-06                              | -3.036E-08                                         | 1.6731E-03              | 1.080E-04                             |
| 14.8             | 999.1325                               | -0.14834                                             | 0.001144                  | -3.037E-05                            | 1.1446E-06                              | -3.023E-08                                         | 1.6839E-03              | 1.086E-04                             |
| 14.9             | 999.1176                               | -0.14953                                             | 0.001141                  | -3.024E-05                            | 1.1416E-06                              | -3.010E-08                                         | 1.6948E-03              | 1.092E-04                             |
| 15.0             | 999.1026                               | -0.15071                                             | 0.001138                  | -3.012E-05                            | 1.1386E-06                              | -2.997E-08                                         | 1.7058E-03              | 1.099E-04                             |
| 15.1             | 999.0875                               | -0.15189                                             | 0.001135                  | -2.999E-05                            | 1.1356E-06                              | -2.984E-08                                         | 1.7168E-03              | 1.105E-04                             |
| 15.2             | 999.0722                               | -0.15306                                             | 0.001132                  | -2.986E-05                            | 1.1326E-06                              | -2.971E-08                                         | 1.7279E-03              | 1.111E-04                             |
| 15.3             | 999.0569                               | -0.15423                                             | 0.001129                  | -2.973E-05                            | 1.1297E-06                              | -2.959E-08                                         | 1.7390E-03              | 1.117E-04                             |
| 15.4             | 999.0414                               | -0.15540                                             | 0.001126                  | -2.961E-05                            | 1.1267E-06                              | -2.946E-08                                         | 1.7502E-03              | 1.124E-04                             |
| 15.5             | 999.0258                               | -0.15657                                             | 0.001123                  | -2.948E-05                            | 1.1238E-06                              | -2.934E-08                                         | 1.7615E-03              | 1.130E-04                             |
| 15.6             | 999.0101                               | -0.15774                                             | 0.001120                  | -2.936E-05                            | 1.1208E-06                              | -2.921E-08                                         | 1.7728E-03              | 1.136E-04                             |
| 15.7             | 998.9943                               | -0.15890                                             | 0.001117                  | -2.924E-05                            | 1.1179E-06                              | -2.909E-08                                         | 1.7842E-03              | 1.143E-04                             |
| 15.8             | 998.9783                               | -0.16006                                             | 0.001114                  | -2.911E-05                            | 1.1150E-06                              | -2.896E-08                                         | 1.7957E-03              | 1.149E-04                             |
| 15.9             | 998.9622                               | -0.16121                                             | 0.001111                  | -2.899E-05                            | 1.1121E-06                              | -2.884E-08                                         | 1.8072E-03              | 1.156E-04                             |
| 16.0             | 998.9461                               | -0.16237                                             | 0.001108                  | -2.887E-05                            | 1.1093E-06                              | -2.872E-08                                         | 1.8188E-03              | 1.162E-04                             |
| 16.1             | 998.9298                               | -0.16352                                             | 0.001105                  | -2.875E-05                            | 1.1064E-06                              | -2.860E-08                                         | 1.8305E-03              | 1.169E-04                             |
| 16.2             | 998.9134                               | -0.16467                                             | 0.001102                  | -2.863E-05                            | 1.1035E-06                              | -2.848E-08                                         | 1.8422E-03              | 1.175E-04                             |
| 16.3             | 998.8968                               | -0.16581                                             | 0.001099                  | -2.851E-05                            | 1.1007E-06                              | -2.836E-08                                         | 1.8540E-03              | 1.182E-04                             |
| 16.4             | 998.8802                               | -0.16695                                             | 0.001097                  | -2.839E-05                            | 1.0979E-06                              | -2.824E-08                                         | 1.8658E-03              | 1.189E-04                             |
| 16.5             | 998.8634                               | -0.16809                                             | 0.001094                  | -2.827E-05                            | 1.0950E-06                              | -2.812E-08                                         | 1.8778E-03              | 1.195E-04                             |
| 16.6             | 998.8466                               | -0.16923                                             | 0.001091                  | -2.815E-05                            | 1.0922E-06                              | -2.800E-08                                         | 1.8897E-03              | 1.202E-04                             |
| 16.7             | 998.8296                               | -0.17037                                             | 0.001088                  | -2.804E-05                            | 1.0894E-06                              | -2.789E-08                                         | 1.9018E-03              | 1.209E-04                             |
| 16.8             | 998.8125                               | -0.17150                                             | 0.001085                  | -2.792E-05                            | 1.0867E-06                              | -2.777E-08                                         | 1.9139E-03              | 1.215E-04                             |
| 16.9             | 998.7953                               | -0.17263                                             | 0.001083                  | -2.781E-05                            | 1.0839E-06                              | -2.765E-08                                         | 1.9261E-03              | 1.222E-04                             |
| 17.0             | 998.7780                               | -0.17376                                             | 0.001080                  | -2.769E-05                            | 1.0811E-06                              | -2.754E-08                                         | 1.9384E-03              | 1.229E-04                             |
| 17.1             | 998.7606                               | -0.17488                                             | 0.001077                  | -2.758E-05                            | 1.0784E-06                              | -2.742E-08                                         | 1.9507E-03              | 1.236E-04                             |
| 17.2             | 998.7430                               | -0.17600                                             | 0.001074                  | -2.747E-05                            | 1.0756E-06                              | -2.731E-08                                         | 1.9631E-03              | 1.243E-04                             |
| 17.3             | 998.7254                               | -0.17712                                             | 0.001072                  | -2.735E-05                            | 1.0729E-06                              | -2.720E-08                                         | 1.9755E-03              | 1.250E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 17.4             | 998.7076                               | -0.17824                                             | 0.001069                  | -2.724E-05                            | 1.0702E-06                              | -2.708E-08                                         | 1.9881E-03              | 1.257E-04                             |
| 17.5             | 998.6897                               | -0.17936                                             | 0.001066                  | -2.713E-05                            | 1.0675E-06                              | -2.697E-08                                         | 2.0007E-03              | 1.264E-04                             |
| 17.6             | 998.6717                               | -0.18047                                             | 0.001063                  | -2.702E-05                            | 1.0648E-06                              | -2.686E-08                                         | 2.0133E-03              | 1.271E-04                             |
| 17.7             | 998.6536                               | -0.18158                                             | 0.001061                  | -2.691E-05                            | 1.0621E-06                              | -2.675E-08                                         | 2.0261E-03              | 1.278E-04                             |
| 17.8             | 998.6354                               | -0.18268                                             | 0.001058                  | -2.680E-05                            | 1.0595E-06                              | -2.664E-08                                         | 2.0389E-03              | 1.285E-04                             |
| 17.9             | 998.6171                               | -0.18379                                             | 0.001055                  | -2.669E-05                            | 1.0568E-06                              | -2.653E-08                                         | 2.0518E-03              | 1.292E-04                             |
| 18.0             | 998.5986                               | -0.18489                                             | 0.001053                  | -2.658E-05                            | 1.0542E-06                              | -2.642E-08                                         | 2.0647E-03              | 1.299E-04                             |
| 18.1             | 998.5801                               | -0.18599                                             | 0.001050                  | -2.647E-05                            | 1.0515E-06                              | -2.631E-08                                         | 2.0778E-03              | 1.306E-04                             |
| 18.2             | 998.5614                               | -0.18709                                             | 0.001047                  | -2.637E-05                            | 1.0489E-06                              | -2.621E-08                                         | 2.0909E-03              | 1.313E-04                             |
| 18.3             | 998.5427                               | -0.18818                                             | 0.001045                  | -2.626E-05                            | 1.0463E-06                              | -2.610E-08                                         | 2.1040E-03              | 1.321E-04                             |
| 18.4             | 998.5238                               | -0.18928                                             | 0.001042                  | -2.615E-05                            | 1.0437E-06                              | -2.599E-08                                         | 2.1173E-03              | 1.328E-04                             |
| 18.5             | 998.5048                               | -0.19037                                             | 0.001040                  | -2.605E-05                            | 1.0411E-06                              | -2.589E-08                                         | 2.1306E-03              | 1.335E-04                             |
| 18.6             | 998.4857                               | -0.19145                                             | 0.001037                  | -2.594E-05                            | 1.0385E-06                              | -2.578E-08                                         | 2.1440E-03              | 1.343E-04                             |
| 18.7             | 998.4665                               | -0.19254                                             | 0.001034                  | -2.584E-05                            | 1.0359E-06                              | -2.568E-08                                         | 2.1574E-03              | 1.350E-04                             |
| 18.8             | 998.4472                               | -0.19362                                             | 0.001032                  | -2.574E-05                            | 1.0334E-06                              | -2.558E-08                                         | 2.1710E-03              | 1.357E-04                             |
| 18.9             | 998.4278                               | -0.19470                                             | 0.001029                  | -2.563E-05                            | 1.0308E-06                              | -2.547E-08                                         | 2.1846E-03              | 1.365E-04                             |
| 19.0             | 998.4083                               | -0.19578                                             | 0.001027                  | -2.553E-05                            | 1.0283E-06                              | -2.537E-08                                         | 2.1983E-03              | 1.372E-04                             |
| 19.1             | 998.3887                               | -0.19686                                             | 0.001024                  | -2.543E-05                            | 1.0257E-06                              | -2.527E-08                                         | 2.2120E-03              | 1.380E-04                             |
| 19.2             | 998.3689                               | -0.19793                                             | 0.001022                  | -2.533E-05                            | 1.0232E-06                              | -2.517E-08                                         | 2.2259E-03              | 1.387E-04                             |
| 19.3             | 998.3491                               | -0.19900                                             | 0.001019                  | -2.523E-05                            | 1.0207E-06                              | -2.506E-08                                         | 2.2398E-03              | 1.395E-04                             |
| 19.4             | 998.3291                               | -0.20007                                             | 0.001016                  | -2.513E-05                            | 1.0182E-06                              | -2.496E-08                                         | 2.2538E-03              | 1.403E-04                             |
| 19.5             | 998.3091                               | -0.20114                                             | 0.001014                  | -2.503E-05                            | 1.0157E-06                              | -2.486E-08                                         | 2.2678E-03              | 1.410E-04                             |
| 19.6             | 998.2889                               | -0.20220                                             | 0.001011                  | -2.493E-05                            | 1.0132E-06                              | -2.476E-08                                         | 2.2820E-03              | 1.418E-04                             |
| 19.7             | 998.2686                               | -0.20326                                             | 0.001009                  | -2.483E-05                            | 1.0108E-06                              | -2.466E-08                                         | 2.2962E-03              | 1.426E-04                             |
| 19.8             | 998.2482                               | -0.20432                                             | 0.001007                  | -2.473E-05                            | 1.0083E-06                              | -2.457E-08                                         | 2.3105E-03              | 1.433E-04                             |
| 19.9             | 998.2277                               | -0.20538                                             | 0.001004                  | -2.463E-05                            | 1.0058E-06                              | -2.447E-08                                         | 2.3249E-03              | 1.441E-04                             |
| 20.0             | 998.2072                               | -0.20644                                             | 0.001002                  | -2.453E-05                            | 1.0034E-06                              | -2.437E-08                                         | 2.3393E-03              | 1.449E-04                             |
| 20.1             | 998.1865                               | -0.20749                                             | 0.000999                  | -2.444E-05                            | 1.0010E-06                              | -2.427E-08                                         | 2.3538E-03              | 1.457E-04                             |
| 20.2             | 998.1657                               | -0.20854                                             | 0.000997                  | -2.434E-05                            | 9.9854E-07                              | -2.418E-08                                         | 2.3685E-03              | 1.465E-04                             |
| 20.3             | 998.1448                               | -0.20959                                             | 0.000994                  | -2.425E-05                            | 9.9613E-07                              | -2.408E-08                                         | 2.3831E-03              | 1.473E-04                             |
| 20.4             | 998.1237                               | -0.21063                                             | 0.000992                  | -2.415E-05                            | 9.9372E-07                              | -2.399E-08                                         | 2.3979E-03              | 1.481E-04                             |
| 20.5             | 998.1026                               | -0.21168                                             | 0.000989                  | -2.406E-05                            | 9.9133E-07                              | -2.389E-08                                         | 2.4128E-03              | 1.489E-04                             |
| 20.6             | 998.0814                               | -0.21272                                             | 0.000987                  | -2.396E-05                            | 9.8895E-07                              | -2.380E-08                                         | 2.4277E-03              | 1.497E-04                             |
| 20.7             | 998.0601                               | -0.21376                                             | 0.000985                  | -2.387E-05                            | 9.8657E-07                              | -2.370E-08                                         | 2.4427E-03              | 1.505E-04                             |
| 20.8             | 998.0387                               | -0.21480                                             | 0.000982                  | -2.378E-05                            | 9.8420E-07                              | -2.361E-08                                         | 2.4578E-03              | 1.513E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 20.9             | 998.0171                               | -0.21583                                             | 0.000980                  | -2.368E-05                            | 9.8185E-07                              | -2.352E-08                                         | 2.4730E-03              | 1.521E-04                             |
| 21.0             | 997.9955                               | -0.21687                                             | 0.000978                  | -2.359E-05                            | 9.7950E-07                              | -2.343E-08                                         | 2.4882E-03              | 1.530E-04                             |
| 21.1             | 997.9737                               | -0.21790                                             | 0.000975                  | -2.350E-05                            | 9.7716E-07                              | -2.333E-08                                         | 2.5036E-03              | 1.538E-04                             |
| 21.2             | 997.9519                               | -0.21893                                             | 0.000973                  | -2.341E-05                            | 9.7483E-07                              | -2.324E-08                                         | 2.5190E-03              | 1.546E-04                             |
| 21.3             | 997.9300                               | -0.21995                                             | 0.000971                  | -2.332E-05                            | 9.7251E-07                              | -2.315E-08                                         | 2.5345E-03              | 1.554E-04                             |
| 21.4             | 997.9079                               | -0.22098                                             | 0.000968                  | -2.323E-05                            | 9.7020E-07                              | -2.306E-08                                         | 2.5501E-03              | 1.563E-04                             |
| 21.5             | 997.8858                               | -0.22200                                             | 0.000966                  | -2.314E-05                            | 9.6790E-07                              | -2.297E-08                                         | 2.5657E-03              | 1.571E-04                             |
| 21.6             | 997.8635                               | -0.22302                                             | 0.000964                  | -2.305E-05                            | 9.6561E-07                              | -2.288E-08                                         | 2.5815E-03              | 1.580E-04                             |
| 21.7             | 997.8412                               | -0.22404                                             | 0.000961                  | -2.296E-05                            | 9.6332E-07                              | -2.279E-08                                         | 2.5973E-03              | 1.588E-04                             |
| 21.8             | 997.8187                               | -0.22506                                             | 0.000959                  | -2.287E-05                            | 9.6105E-07                              | -2.271E-08                                         | 2.6132E-03              | 1.596E-04                             |
| 21.9             | 997.7962                               | -0.22607                                             | 0.000957                  | -2.279E-05                            | 9.5878E-07                              | -2.262E-08                                         | 2.6293E-03              | 1.605E-04                             |
| 22.0             | 997.7735                               | -0.22708                                             | 0.000954                  | -2.270E-05                            | 9.5653E-07                              | -2.253E-08                                         | 2.6453E-03              | 1.614E-04                             |
| 22.1             | 997.7507                               | -0.22809                                             | 0.000952                  | -2.261E-05                            | 9.5428E-07                              | -2.244E-08                                         | 2.6615E-03              | 1.622E-04                             |
| 22.2             | 997.7279                               | -0.22910                                             | 0.000950                  | -2.252E-05                            | 9.5204E-07                              | -2.236E-08                                         | 2.6778E-03              | 1.631E-04                             |
| 22.3             | 997.7049                               | -0.23011                                             | 0.000948                  | -2.244E-05                            | 9.4981E-07                              | -2.227E-08                                         | 2.6941E-03              | 1.640E-04                             |
| 22.4             | 997.6819                               | -0.23111                                             | 0.000945                  | -2.235E-05                            | 9.4758E-07                              | -2.219E-08                                         | 2.7106E-03              | 1.648E-04                             |
| 22.5             | 997.6587                               | -0.23211                                             | 0.000943                  | -2.227E-05                            | 9.4537E-07                              | -2.210E-08                                         | 2.7271E-03              | 1.657E-04                             |
| 22.6             | 997.6354                               | -0.23311                                             | 0.000941                  | -2.218E-05                            | 9.4316E-07                              | -2.202E-08                                         | 2.7437E-03              | 1.666E-04                             |
| 22.7             | 997.6121                               | -0.23411                                             | 0.000939                  | -2.210E-05                            | 9.4097E-07                              | -2.193E-08                                         | 2.7604E-03              | 1.675E-04                             |
| 22.8             | 997.5886                               | -0.23511                                             | 0.000937                  | -2.202E-05                            | 9.3878E-07                              | -2.185E-08                                         | 2.7772E-03              | 1.684E-04                             |
| 22.9             | 997.5650                               | -0.23610                                             | 0.000934                  | -2.193E-05                            | 9.3660E-07                              | -2.176E-08                                         | 2.7941E-03              | 1.693E-04                             |
| 23.0             | 997.5414                               | -0.23709                                             | 0.000932                  | -2.185E-05                            | 9.3442E-07                              | -2.168E-08                                         | 2.8111E-03              | 1.702E-04                             |
| 23.1             | 997.5176                               | -0.23808                                             | 0.000930                  | -2.177E-05                            | 9.3226E-07                              | -2.160E-08                                         | 2.8281E-03              | 1.711E-04                             |
| 23.2             | 997.4938                               | -0.23907                                             | 0.000928                  | -2.169E-05                            | 9.3010E-07                              | -2.152E-08                                         | 2.8453E-03              | 1.720E-04                             |
| 23.3             | 997.4698                               | -0.24006                                             | 0.000926                  | -2.160E-05                            | 9.2796E-07                              | -2.144E-08                                         | 2.8625E-03              | 1.729E-04                             |
| 23.4             | 997.4458                               | -0.24104                                             | 0.000923                  | -2.152E-05                            | 9.2582E-07                              | -2.135E-08                                         | 2.8799E-03              | 1.738E-04                             |
| 23.5             | 997.4216                               | -0.24202                                             | 0.000921                  | -2.144E-05                            | 9.2368E-07                              | -2.127E-08                                         | 2.8973E-03              | 1.747E-04                             |
| 23.6             | 997.3974                               | -0.24300                                             | 0.000919                  | -2.136E-05                            | 9.2156E-07                              | -2.119E-08                                         | 2.9148E-03              | 1.756E-04                             |
| 23.7             | 997.3730                               | -0.24398                                             | 0.000917                  | -2.128E-05                            | 9.1945E-07                              | -2.111E-08                                         | 2.9324E-03              | 1.766E-04                             |
| 23.8             | 997.3486                               | -0.24496                                             | 0.000915                  | -2.120E-05                            | 9.1734E-07                              | -2.103E-08                                         | 2.9501E-03              | 1.775E-04                             |
| 23.9             | 997.3240                               | -0.24593                                             | 0.000913                  | -2.112E-05                            | 9.1524E-07                              | -2.095E-08                                         | 2.9679E-03              | 1.784E-04                             |
| 24.0             | 997.2994                               | -0.24691                                             | 0.000911                  | -2.104E-05                            | 9.1315E-07                              | -2.088E-08                                         | 2.9858E-03              | 1.794E-04                             |
| 24.1             | 997.2746                               | -0.24788                                             | 0.000909                  | -2.097E-05                            | 9.1106E-07                              | -2.080E-08                                         | 3.0038E-03              | 1.803E-04                             |
| 24.2             | 997.2498                               | -0.24885                                             | 0.000906                  | -2.089E-05                            | 9.0899E-07                              | -2.072E-08                                         | 3.0219E-03              | 1.812E-04                             |
| 24.3             | 997.2249                               | -0.24981                                             | 0.000904                  | -2.081E-05                            | 9.0692E-07                              | -2.064E-08                                         | 3.0400E-03              | 1.822E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 24.4             | 997.1998                               | -0.25078                                             | 0.000902                  | -2.073E-05                            | 9.0486E-07                              | -2.056E-08                                         | 3.0583E-03              | 1.832E-04                             |
| 24.5             | 997.1747                               | -0.25174                                             | 0.000900                  | -2.066E-05                            | 9.0281E-07                              | -2.049E-08                                         | 3.0767E-03              | 1.841E-04                             |
| 24.6             | 997.1495                               | -0.25270                                             | 0.000898                  | -2.058E-05                            | 9.0076E-07                              | -2.041E-08                                         | 3.0951E-03              | 1.851E-04                             |
| 24.7             | 997.1242                               | -0.25366                                             | 0.000896                  | -2.051E-05                            | 8.9872E-07                              | -2.034E-08                                         | 3.1137E-03              | 1.860E-04                             |
| 24.8             | 997.0988                               | -0.25462                                             | 0.000894                  | -2.043E-05                            | 8.9669E-07                              | -2.026E-08                                         | 3.1323E-03              | 1.870E-04                             |
| 24.9             | 997.0732                               | -0.25558                                             | 0.000892                  | -2.035E-05                            | 8.9467E-07                              | -2.018E-08                                         | 3.1511E-03              | 1.880E-04                             |
| 25.0             | 997.0476                               | -0.25653                                             | 0.000890                  | -2.028E-05                            | 8.9266E-07                              | -2.011E-08                                         | 3.1699E-03              | 1.890E-04                             |
| 25.1             | 997.0219                               | -0.25748                                             | 0.000888                  | -2.021E-05                            | 8.9065E-07                              | -2.004E-08                                         | 3.1889E-03              | 1.900E-04                             |
| 25.2             | 996.9961                               | -0.25843                                             | 0.000886                  | -2.013E-05                            | 8.8865E-07                              | -1.996E-08                                         | 3.2079E-03              | 1.909E-04                             |
| 25.3             | 996.9703                               | -0.25938                                             | 0.000884                  | -2.006E-05                            | 8.8666E-07                              | -1.989E-08                                         | 3.2271E-03              | 1.919E-04                             |
| 25.4             | 996.9443                               | -0.26033                                             | 0.000882                  | -1.998E-05                            | 8.8467E-07                              | -1.981E-08                                         | 3.2463E-03              | 1.929E-04                             |
| 25.5             | 996.9182                               | -0.26127                                             | 0.000880                  | -1.991E-05                            | 8.8270E-07                              | -1.974E-08                                         | 3.2657E-03              | 1.939E-04                             |
| 25.6             | 996.8920                               | -0.26222                                             | 0.000878                  | -1.984E-05                            | 8.8072E-07                              | -1.967E-08                                         | 3.2851E-03              | 1.949E-04                             |
| 25.7             | 996.8657                               | -0.26316                                             | 0.000876                  | -1.977E-05                            | 8.7876E-07                              | -1.960E-08                                         | 3.3046E-03              | 1.960E-04                             |
| 25.8             | 996.8394                               | -0.26410                                             | 0.000874                  | -1.970E-05                            | 8.7681E-07                              | -1.953E-08                                         | 3.3243E-03              | 1.970E-04                             |
| 25.9             | 996.8129                               | -0.26503                                             | 0.000872                  | -1.962E-05                            | 8.7486E-07                              | -1.945E-08                                         | 3.3440E-03              | 1.980E-04                             |
| 26.0             | 996.7864                               | -0.26597                                             | 0.000870                  | -1.955E-05                            | 8.7291E-07                              | -1.938E-08                                         | 3.3639E-03              | 1.990E-04                             |
| 26.1             | 996.7597                               | -0.26691                                             | 0.000868                  | -1.948E-05                            | 8.7098E-07                              | -1.931E-08                                         | 3.3838E-03              | 2.000E-04                             |
| 26.2             | 996.7330                               | -0.26784                                             | 0.000866                  | -1.941E-05                            | 8.6905E-07                              | -1.924E-08                                         | 3.4039E-03              | 2.011E-04                             |
| 26.3             | 996.7062                               | -0.26877                                             | 0.000864                  | -1.934E-05                            | 8.6713E-07                              | -1.917E-08                                         | 3.4241E-03              | 2.021E-04                             |
| 26.4             | 996.6792                               | -0.26970                                             | 0.000862                  | -1.927E-05                            | 8.6522E-07                              | -1.910E-08                                         | 3.4443E-03              | 2.032E-04                             |
| 26.5             | 996.6522                               | -0.27063                                             | 0.000860                  | -1.920E-05                            | 8.6331E-07                              | -1.903E-08                                         | 3.4647E-03              | 2.042E-04                             |
| 26.6             | 996.6251                               | -0.27155                                             | 0.000859                  | -1.913E-05                            | 8.6141E-07                              | -1.896E-08                                         | 3.4852E-03              | 2.053E-04                             |
| 26.7             | 996.5979                               | -0.27248                                             | 0.000857                  | -1.906E-05                            | 8.5952E-07                              | -1.889E-08                                         | 3.5057E-03              | 2.063E-04                             |
| 26.8             | 996.5706                               | -0.27340                                             | 0.000855                  | -1.900E-05                            | 8.5763E-07                              | -1.883E-08                                         | 3.5264E-03              | 2.074E-04                             |
| 26.9             | 996.5432                               | -0.27432                                             | 0.000853                  | -1.893E-05                            | 8.5575E-07                              | -1.876E-08                                         | 3.5472E-03              | 2.084E-04                             |
| 27.0             | 996.5158                               | -0.27524                                             | 0.000851                  | -1.886E-05                            | 8.5388E-07                              | -1.869E-08                                         | 3.5681E-03              | 2.095E-04                             |
| 27.1             | 996.4882                               | -0.27616                                             | 0.000849                  | -1.879E-05                            | 8.5202E-07                              | -1.862E-08                                         | 3.5891E-03              | 2.106E-04                             |
| 27.2             | 996.4605                               | -0.27707                                             | 0.000847                  | -1.873E-05                            | 8.5016E-07                              | -1.856E-08                                         | 3.6102E-03              | 2.117E-04                             |
| 27.3             | 996.4328                               | -0.27799                                             | 0.000845                  | -1.866E-05                            | 8.4830E-07                              | -1.849E-08                                         | 3.6314E-03              | 2.127E-04                             |
| 27.4             | 996.4049                               | -0.27890                                             | 0.000843                  | -1.859E-05                            | 8.4646E-07                              | -1.842E-08                                         | 3.6528E-03              | 2.138E-04                             |
| 27.5             | 996.3770                               | -0.27981                                             | 0.000842                  | -1.853E-05                            | 8.4462E-07                              | -1.836E-08                                         | 3.6742E-03              | 2.149E-04                             |
| 27.6             | 996.3490                               | -0.28072                                             | 0.000840                  | -1.846E-05                            | 8.4279E-07                              | -1.829E-08                                         | 3.6958E-03              | 2.160E-04                             |
| 27.7             | 996.3209                               | -0.28162                                             | 0.000838                  | -1.840E-05                            | 8.4096E-07                              | -1.823E-08                                         | 3.7174E-03              | 2.171E-04                             |
| 27.8             | 996.2926                               | -0.28253                                             | 0.000836                  | -1.833E-05                            | 8.3914E-07                              | -1.816E-08                                         | 3.7392E-03              | 2.182E-04                             |



| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 27.9             | 996.2643                               | -0.28343                                             | 0.000834                  | -1.827E-05                            | 8.3733E-07                              | -1.810E-08                                         | 3.7611E-03              | 2.193E-04                             |
| 28.0             | 996.2360                               | -0.28434                                             | 0.000832                  | -1.820E-05                            | 8.3552E-07                              | -1.803E-08                                         | 3.7831E-03              | 2.205E-04                             |
| 28.1             | 996.2075                               | -0.28524                                             | 0.000831                  | -1.814E-05                            | 8.3372E-07                              | -1.797E-08                                         | 3.8052E-03              | 2.216E-04                             |
| 28.2             | 996.1789                               | -0.28614                                             | 0.000829                  | -1.807E-05                            | 8.3193E-07                              | -1.790E-08                                         | 3.8274E-03              | 2.227E-04                             |
| 28.3             | 996.1503                               | -0.28704                                             | 0.000827                  | -1.801E-05                            | 8.3014E-07                              | -1.784E-08                                         | 3.8497E-03              | 2.238E-04                             |
| 28.4             | 996.1215                               | -0.28793                                             | 0.000825                  | -1.795E-05                            | 8.2836E-07                              | -1.778E-08                                         | 3.8721E-03              | 2.250E-04                             |
| 28.5             | 996.0927                               | -0.28883                                             | 0.000823                  | -1.788E-05                            | 8.2659E-07                              | -1.771E-08                                         | 3.8947E-03              | 2.261E-04                             |
| 28.6             | 996.0637                               | -0.28972                                             | 0.000822                  | -1.782E-05                            | 8.2482E-07                              | -1.765E-08                                         | 3.9174E-03              | 2.273E-04                             |
| 28.7             | 996.0347                               | -0.29061                                             | 0.000820                  | -1.776E-05                            | 8.2306E-07                              | -1.759E-08                                         | 3.9401E-03              | 2.284E-04                             |
| 28.8             | 996.0056                               | -0.29150                                             | 0.000818                  | -1.770E-05                            | 8.2130E-07                              | -1.753E-08                                         | 3.9630E-03              | 2.296E-04                             |
| 28.9             | 995.9764                               | -0.29239                                             | 0.000816                  | -1.763E-05                            | 8.1955E-07                              | -1.747E-08                                         | 3.9860E-03              | 2.307E-04                             |
| 29.0             | 995.9471                               | -0.29327                                             | 0.000814                  | -1.757E-05                            | 8.1781E-07                              | -1.740E-08                                         | 4.0092E-03              | 2.319E-04                             |
| 29.1             | 995.9178                               | -0.29416                                             | 0.000813                  | -1.751E-05                            | 8.1607E-07                              | -1.734E-08                                         | 4.0324E-03              | 2.330E-04                             |
| 29.2             | 995.8883                               | -0.29504                                             | 0.000811                  | -1.745E-05                            | 8.1434E-07                              | -1.728E-08                                         | 4.0558E-03              | 2.342E-04                             |
| 29.3             | 995.8588                               | -0.29593                                             | 0.000809                  | -1.739E-05                            | 8.1261E-07                              | -1.722E-08                                         | 4.0793E-03              | 2.354E-04                             |
| 29.4             | 995.8291                               | -0.29681                                             | 0.000808                  | -1.733E-05                            | 8.1089E-07                              | -1.716E-08                                         | 4.1029E-03              | 2.366E-04                             |
| 29.5             | 995.7994                               | -0.29768                                             | 0.000806                  | -1.727E-05                            | 8.0918E-07                              | -1.710E-08                                         | 4.1266E-03              | 2.378E-04                             |
| 29.6             | 995.7696                               | -0.29856                                             | 0.000804                  | -1.721E-05                            | 8.0747E-07                              | -1.704E-08                                         | 4.1504E-03              | 2.390E-04                             |
| 29.7             | 995.7397                               | -0.29944                                             | 0.000802                  | -1.715E-05                            | 8.0577E-07                              | -1.698E-08                                         | 4.1744E-03              | 2.402E-04                             |
| 29.8             | 995.7097                               | -0.30031                                             | 0.000801                  | -1.709E-05                            | 8.0408E-07                              | -1.692E-08                                         | 4.1985E-03              | 2.414E-04                             |
| 29.9             | 995.6796                               | -0.30119                                             | 0.000799                  | -1.703E-05                            | 8.0239E-07                              | -1.686E-08                                         | 4.2227E-03              | 2.426E-04                             |
| 30.0             | 995.6495                               | -0.30206                                             | 0.000797                  | -1.697E-05                            | 8.0071E-07                              | -1.681E-08                                         | 4.2470E-03              | 2.438E-04                             |
| 30.1             | 995.6192                               | -0.30293                                             | 0.000796                  | -1.692E-05                            | 7.9903E-07                              | -1.675E-08                                         | 4.2714E-03              | 2.450E-04                             |
| 30.2             | 995.5889                               | -0.30380                                             | 0.000794                  | -1.686E-05                            | 7.9736E-07                              | -1.669E-08                                         | 4.2960E-03              | 2.462E-04                             |
| 30.3             | 995.5585                               | -0.30466                                             | 0.000792                  | -1.680E-05                            | 7.9569E-07                              | -1.663E-08                                         | 4.3207E-03              | 2.475E-04                             |
| 30.4             | 995.5279                               | -0.30553                                             | 0.000790                  | -1.674E-05                            | 7.9403E-07                              | -1.657E-08                                         | 4.3455E-03              | 2.487E-04                             |
| 30.5             | 995.4973                               | -0.30639                                             | 0.000789                  | -1.669E-05                            | 7.9237E-07                              | -1.652E-08                                         | 4.3704E-03              | 2.499E-04                             |
| 30.6             | 995.4667                               | -0.30725                                             | 0.000787                  | -1.663E-05                            | 7.9073E-07                              | -1.646E-08                                         | 4.3955E-03              | 2.512E-04                             |
| 30.7             | 995.4359                               | -0.30812                                             | 0.000785                  | -1.657E-05                            | 7.8908E-07                              | -1.640E-08                                         | 4.4206E-03              | 2.524E-04                             |
| 30.8             | 995.4050                               | -0.30897                                             | 0.000784                  | -1.651E-05                            | 7.8745E-07                              | -1.635E-08                                         | 4.4459E-03              | 2.537E-04                             |
| 30.9             | 995.3741                               | -0.30983                                             | 0.000782                  | -1.646E-05                            | 7.8581E-07                              | -1.629E-08                                         | 4.4714E-03              | 2.549E-04                             |
| 31.0             | 995.3431                               | -0.31069                                             | 0.000781                  | -1.640E-05                            | 7.8419E-07                              | -1.624E-08                                         | 4.4969E-03              | 2.562E-04                             |
| 31.1             | 995.3120                               | -0.31154                                             | 0.000779                  | -1.635E-05                            | 7.8257E-07                              | -1.618E-08                                         | 4.5226E-03              | 2.575E-04                             |
| 31.2             | 995.2808                               | -0.31240                                             | 0.000777                  | -1.629E-05                            | 7.8095E-07                              | -1.612E-08                                         | 4.5484E-03              | 2.588E-04                             |
| 31.3             | 995.2495                               | -0.31325                                             | 0.000776                  | -1.624E-05                            | 7.7934E-07                              | -1.607E-08                                         | 4.5744E-03              | 2.600E-04                             |



| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 31.4             | 995.2181                               | -0.31410                                             | 0.000774                  | -1.618E-05                            | 7.7774E-07                              | -1.601E-08                                         | 4.6004E-03              | 2.613E-04                             |
| 31.5             | 995.1867                               | -0.31495                                             | 0.000772                  | -1.613E-05                            | 7.7614E-07                              | -1.596E-08                                         | 4.6266E-03              | 2.626E-04                             |
| 31.6             | 995.1551                               | -0.31580                                             | 0.000771                  | -1.607E-05                            | 7.7455E-07                              | -1.591E-08                                         | 4.6530E-03              | 2.639E-04                             |
| 31.7             | 995.1235                               | -0.31665                                             | 0.000769                  | -1.602E-05                            | 7.7296E-07                              | -1.585E-08                                         | 4.6794E-03              | 2.652E-04                             |
| 31.8             | 995.0918                               | -0.31749                                             | 0.000768                  | -1.596E-05                            | 7.7138E-07                              | -1.580E-08                                         | 4.7060E-03              | 2.665E-04                             |
| 31.9             | 995.0600                               | -0.31834                                             | 0.000766                  | -1.591E-05                            | 7.6980E-07                              | -1.574E-08                                         | 4.7327E-03              | 2.678E-04                             |
| 32.0             | 995.0281                               | -0.31918                                             | 0.000764                  | -1.586E-05                            | 7.6823E-07                              | -1.569E-08                                         | 4.7596E-03              | 2.692E-04                             |
| 32.1             | 994.9962                               | -0.32002                                             | 0.000763                  | -1.580E-05                            | 7.6666E-07                              | -1.564E-08                                         | 4.7866E-03              | 2.705E-04                             |
| 32.2             | 994.9641                               | -0.32086                                             | 0.000761                  | -1.575E-05                            | 7.6510E-07                              | -1.559E-08                                         | 4.8137E-03              | 2.718E-04                             |
| 32.3             | 994.9320                               | -0.32170                                             | 0.000760                  | -1.570E-05                            | 7.6354E-07                              | -1.553E-08                                         | 4.8409E-03              | 2.732E-04                             |
| 32.4             | 994.8998                               | -0.32253                                             | 0.000758                  | -1.565E-05                            | 7.6199E-07                              | -1.548E-08                                         | 4.8683E-03              | 2.745E-04                             |
| 32.5             | 994.8675                               | -0.32337                                             | 0.000757                  | -1.560E-05                            | 7.6045E-07                              | -1.543E-08                                         | 4.8958E-03              | 2.758E-04                             |
| 32.6             | 994.8351                               | -0.32420                                             | 0.000755                  | -1.554E-05                            | 7.5891E-07                              | -1.538E-08                                         | 4.9235E-03              | 2.772E-04                             |
| 32.7             | 994.8026                               | -0.32504                                             | 0.000753                  | -1.549E-05                            | 7.5737E-07                              | -1.532E-08                                         | 4.9513E-03              | 2.785E-04                             |
| 32.8             | 994.7701                               | -0.32587                                             | 0.000752                  | -1.544E-05                            | 7.5584E-07                              | -1.527E-08                                         | 4.9792E-03              | 2.799E-04                             |
| 32.9             | 994.7375                               | -0.32670                                             | 0.000750                  | -1.539E-05                            | 7.5432E-07                              | -1.522E-08                                         | 5.0072E-03              | 2.813E-04                             |
| 33.0             | 994.7048                               | -0.32753                                             | 0.000749                  | -1.534E-05                            | 7.5280E-07                              | -1.517E-08                                         | 5.0354E-03              | 2.826E-04                             |
| 33.1             | 994.6720                               | -0.32836                                             | 0.000747                  | -1.529E-05                            | 7.5128E-07                              | -1.512E-08                                         | 5.0638E-03              | 2.840E-04                             |
| 33.2             | 994.6391                               | -0.32918                                             | 0.000746                  | -1.524E-05                            | 7.4977E-07                              | -1.507E-08                                         | 5.0922E-03              | 2.854E-04                             |
| 33.3             | 994.6061                               | -0.33001                                             | 0.000744                  | -1.519E-05                            | 7.4827E-07                              | -1.502E-08                                         | 5.1208E-03              | 2.868E-04                             |
| 33.4             | 994.5731                               | -0.33083                                             | 0.000743                  | -1.514E-05                            | 7.4677E-07                              | -1.497E-08                                         | 5.1496E-03              | 2.882E-04                             |
| 33.5             | 994.5400                               | -0.33165                                             | 0.000741                  | -1.509E-05                            | 7.4528E-07                              | -1.492E-08                                         | 5.1785E-03              | 2.896E-04                             |
| 33.6             | 994.5068                               | -0.33247                                             | 0.000740                  | -1.504E-05                            | 7.4379E-07                              | -1.487E-08                                         | 5.2075E-03              | 2.910E-04                             |
| 33.7             | 994.4735                               | -0.33329                                             | 0.000738                  | -1.499E-05                            | 7.4230E-07                              | -1.482E-08                                         | 5.2367E-03              | 2.924E-04                             |
| 33.8             | 994.4401                               | -0.33411                                             | 0.000737                  | -1.494E-05                            | 7.4082E-07                              | -1.477E-08                                         | 5.2660E-03              | 2.938E-04                             |
| 33.9             | 994.4067                               | -0.33493                                             | 0.000735                  | -1.489E-05                            | 7.3935E-07                              | -1.472E-08                                         | 5.2955E-03              | 2.953E-04                             |
| 34.0             | 994.3731                               | -0.33574                                             | 0.000734                  | -1.484E-05                            | 7.3788E-07                              | -1.467E-08                                         | 5.3251E-03              | 2.967E-04                             |
| 34.1             | 994.3395                               | -0.33656                                             | 0.000732                  | -1.479E-05                            | 7.3641E-07                              | -1.463E-08                                         | 5.3548E-03              | 2.981E-04                             |
| 34.2             | 994.3058                               | -0.33737                                             | 0.000731                  | -1.474E-05                            | 7.3495E-07                              | -1.458E-08                                         | 5.3847E-03              | 2.996E-04                             |
| 34.3             | 994.2720                               | -0.33818                                             | 0.000729                  | -1.469E-05                            | 7.3350E-07                              | -1.453E-08                                         | 5.4147E-03              | 3.010E-04                             |
| 34.4             | 994.2382                               | -0.33899                                             | 0.000728                  | -1.465E-05                            | 7.3205E-07                              | -1.448E-08                                         | 5.4449E-03              | 3.025E-04                             |
| 34.5             | 994.2042                               | -0.33980                                             | 0.000726                  | -1.460E-05                            | 7.3060E-07                              | -1.443E-08                                         | 5.4752E-03              | 3.039E-04                             |
| 34.6             | 994.1702                               | -0.34061                                             | 0.000725                  | -1.455E-05                            | 7.2916E-07                              | -1.439E-08                                         | 5.5057E-03              | 3.054E-04                             |
| 34.7             | 994.1361                               | -0.34142                                             | 0.000723                  | -1.450E-05                            | 7.2772E-07                              | -1.434E-08                                         | 5.5363E-03              | 3.069E-04                             |
| 34.8             | 994.1019                               | -0.34222                                             | 0.000722                  | -1.446E-05                            | 7.2629E-07                              | -1.429E-08                                         | 5.5671E-03              | 3.083E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 34.9             | 994.0677                               | -0.34303                                             | 0.000721                  | -1.441E-05                            | 7.2486E-07                              | -1.425E-08                                         | 5.5980E-03              | 3.098E-04                             |
| 35.0             | 994.0333                               | -0.34383                                             | 0.000719                  | -1.436E-05                            | 7.2344E-07                              | -1.420E-08                                         | 5.6290E-03              | 3.113E-04                             |
| 35.1             | 993.9989                               | -0.34463                                             | 0.000718                  | -1.432E-05                            | 7.2202E-07                              | -1.415E-08                                         | 5.6602E-03              | 3.128E-04                             |
| 35.2             | 993.9644                               | -0.34543                                             | 0.000716                  | -1.427E-05                            | 7.2061E-07                              | -1.411E-08                                         | 5.6916E-03              | 3.143E-04                             |
| 35.3             | 993.9298                               | -0.34623                                             | 0.000715                  | -1.422E-05                            | 7.1920E-07                              | -1.406E-08                                         | 5.7231E-03              | 3.158E-04                             |
| 35.4             | 993.8951                               | -0.34703                                             | 0.000713                  | -1.418E-05                            | 7.1780E-07                              | -1.401E-08                                         | 5.7547E-03              | 3.173E-04                             |
| 35.5             | 993.8604                               | -0.34783                                             | 0.000712                  | -1.413E-05                            | 7.1640E-07                              | -1.397E-08                                         | 5.7866E-03              | 3.189E-04                             |
| 35.6             | 993.8256                               | -0.34862                                             | 0.000711                  | -1.409E-05                            | 7.1501E-07                              | -1.392E-08                                         | 5.8185E-03              | 3.204E-04                             |
| 35.7             | 993.7907                               | -0.34942                                             | 0.000709                  | -1.404E-05                            | 7.1362E-07                              | -1.388E-08                                         | 5.8506E-03              | 3.219E-04                             |
| 35.8             | 993.7557                               | -0.35021                                             | 0.000708                  | -1.400E-05                            | 7.1223E-07                              | -1.383E-08                                         | 5.8829E-03              | 3.234E-04                             |
| 35.9             | 993.7206                               | -0.35100                                             | 0.000706                  | -1.395E-05                            | 7.1085E-07                              | -1.379E-08                                         | 5.9153E-03              | 3.250E-04                             |
| 36.0             | 993.6855                               | -0.35179                                             | 0.000705                  | -1.391E-05                            | 7.0947E-07                              | -1.375E-08                                         | 5.9479E-03              | 3.265E-04                             |
| 36.1             | 993.6503                               | -0.35258                                             | 0.000704                  | -1.386E-05                            | 7.0810E-07                              | -1.370E-08                                         | 5.9806E-03              | 3.281E-04                             |
| 36.2             | 993.6150                               | -0.35337                                             | 0.000702                  | -1.382E-05                            | 7.0673E-07                              | -1.366E-08                                         | 6.0135E-03              | 3.297E-04                             |
| 36.3             | 993.5796                               | -0.35416                                             | 0.000701                  | -1.377E-05                            | 7.0537E-07                              | -1.361E-08                                         | 6.0466E-03              | 3.312E-04                             |
| 36.4             | 993.5442                               | -0.35494                                             | 0.000699                  | -1.373E-05                            | 7.0401E-07                              | -1.357E-08                                         | 6.0798E-03              | 3.328E-04                             |
| 36.5             | 993.5086                               | -0.35573                                             | 0.000698                  | -1.369E-05                            | 7.0265E-07                              | -1.353E-08                                         | 6.1131E-03              | 3.344E-04                             |
| 36.6             | 993.4730                               | -0.35651                                             | 0.000697                  | -1.364E-05                            | 7.0130E-07                              | -1.348E-08                                         | 6.1466E-03              | 3.360E-04                             |
| 36.7             | 993.4373                               | -0.35729                                             | 0.000695                  | -1.360E-05                            | 6.9996E-07                              | -1.344E-08                                         | 6.1803E-03              | 3.376E-04                             |
| 36.8             | 993.4015                               | -0.35808                                             | 0.000694                  | -1.356E-05                            | 6.9862E-07                              | -1.340E-08                                         | 6.2141E-03              | 3.392E-04                             |
| 36.9             | 993.3657                               | -0.35886                                             | 0.000693                  | -1.351E-05                            | 6.9728E-07                              | -1.335E-08                                         | 6.2481E-03              | 3.408E-04                             |
| 37.0             | 993.3298                               | -0.35963                                             | 0.000691                  | -1.347E-05                            | 6.9595E-07                              | -1.331E-08                                         | 6.2823E-03              | 3.424E-04                             |
| 37.1             | 993.2938                               | -0.36041                                             | 0.000690                  | -1.343E-05                            | 6.9462E-07                              | -1.327E-08                                         | 6.3166E-03              | 3.440E-04                             |
| 37.2             | 993.2577                               | -0.36119                                             | 0.000689                  | -1.339E-05                            | 6.9329E-07                              | -1.323E-08                                         | 6.3511E-03              | 3.456E-04                             |
| 37.3             | 993.2215                               | -0.36196                                             | 0.000687                  | -1.334E-05                            | 6.9197E-07                              | -1.318E-08                                         | 6.3857E-03              | 3.472E-04                             |
| 37.4             | 993.1853                               | -0.36274                                             | 0.000686                  | -1.330E-05                            | 6.9066E-07                              | -1.314E-08                                         | 6.4205E-03              | 3.489E-04                             |
| 37.5             | 993.1490                               | -0.36351                                             | 0.000685                  | -1.326E-05                            | 6.8934E-07                              | -1.310E-08                                         | 6.4555E-03              | 3.505E-04                             |
| 37.6             | 993.1126                               | -0.36428                                             | 0.000683                  | -1.322E-05                            | 6.8804E-07                              | -1.306E-08                                         | 6.4906E-03              | 3.522E-04                             |
| 37.7             | 993.0761                               | -0.36505                                             | 0.000682                  | -1.318E-05                            | 6.8673E-07                              | -1.302E-08                                         | 6.5259E-03              | 3.538E-04                             |
| 37.8             | 993.0396                               | -0.36582                                             | 0.000681                  | -1.314E-05                            | 6.8543E-07                              | -1.298E-08                                         | 6.5614E-03              | 3.555E-04                             |
| 37.9             | 993.0030                               | -0.36659                                             | 0.000679                  | -1.309E-05                            | 6.8414E-07                              | -1.293E-08                                         | 6.5970E-03              | 3.572E-04                             |
| 38.0             | 992.9663                               | -0.36736                                             | 0.000678                  | -1.305E-05                            | 6.8285E-07                              | -1.289E-08                                         | 6.6328E-03              | 3.588E-04                             |
| 38.1             | 992.9295                               | -0.36813                                             | 0.000677                  | -1.301E-05                            | 6.8156E-07                              | -1.285E-08                                         | 6.6688E-03              | 3.605E-04                             |
| 38.2             | 992.8926                               | -0.36889                                             | 0.000675                  | -1.297E-05                            | 6.8027E-07                              | -1.281E-08                                         | 6.7049E-03              | 3.622E-04                             |
| 38.3             | 992.8557                               | -0.36966                                             | 0.000674                  | -1.293E-05                            | 6.7900E-07                              | -1.277E-08                                         | 6.7412E-03              | 3.639E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 38.4             | 992.8187                               | -0.37042                                             | 0.000673                  | -1.289E-05                            | 6.7772E-07                              | -1.273E-08                                         | 6.7777E-03              | 3.656E-04                             |
| 38.5             | 992.7816                               | -0.37118                                             | 0.000672                  | -1.285E-05                            | 6.7645E-07                              | -1.269E-08                                         | 6.8144E-03              | 3.673E-04                             |
| 38.6             | 992.7445                               | -0.37194                                             | 0.000670                  | -1.281E-05                            | 6.7518E-07                              | -1.265E-08                                         | 6.8512E-03              | 3.690E-04                             |
| 38.7             | 992.7072                               | -0.37270                                             | 0.000669                  | -1.277E-05                            | 6.7392E-07                              | -1.261E-08                                         | 6.8882E-03              | 3.707E-04                             |
| 38.8             | 992.6699                               | -0.37346                                             | 0.000668                  | -1.273E-05                            | 6.7266E-07                              | -1.257E-08                                         | 6.9253E-03              | 3.725E-04                             |
| 38.9             | 992.6326                               | -0.37422                                             | 0.000666                  | -1.269E-05                            | 6.7140E-07                              | -1.253E-08                                         | 6.9627E-03              | 3.742E-04                             |
| 39.0             | 992.5951                               | -0.37497                                             | 0.000665                  | -1.265E-05                            | 6.7015E-07                              | -1.250E-08                                         | 7.0002E-03              | 3.759E-04                             |
| 39.1             | 992.5576                               | -0.37573                                             | 0.000664                  | -1.262E-05                            | 6.6890E-07                              | -1.246E-08                                         | 7.0378E-03              | 3.777E-04                             |
| 39.2             | 992.5199                               | -0.37648                                             | 0.000663                  | -1.258E-05                            | 6.6766E-07                              | -1.242E-08                                         | 7.0757E-03              | 3.794E-04                             |
| 39.3             | 992.4823                               | -0.37724                                             | 0.000661                  | -1.254E-05                            | 6.6642E-07                              | -1.238E-08                                         | 7.1137E-03              | 3.812E-04                             |
| 39.4             | 992.4445                               | -0.37799                                             | 0.000660                  | -1.250E-05                            | 6.6518E-07                              | -1.234E-08                                         | 7.1519E-03              | 3.830E-04                             |
| 39.5             | 992.4067                               | -0.37874                                             | 0.000659                  | -1.246E-05                            | 6.6395E-07                              | -1.230E-08                                         | 7.1903E-03              | 3.847E-04                             |
| 39.6             | 992.3688                               | -0.37949                                             | 0.000658                  | -1.242E-05                            | 6.6272E-07                              | -1.226E-08                                         | 7.2289E-03              | 3.865E-04                             |
| 39.7             | 992.3308                               | -0.38024                                             | 0.000656                  | -1.238E-05                            | 6.6150E-07                              | -1.223E-08                                         | 7.2676E-03              | 3.883E-04                             |
| 39.8             | 992.2927                               | -0.38099                                             | 0.000655                  | -1.235E-05                            | 6.6028E-07                              | -1.219E-08                                         | 7.3066E-03              | 3.901E-04                             |
| 39.9             | 992.2546                               | -0.38173                                             | 0.000654                  | -1.231E-05                            | 6.5906E-07                              | -1.215E-08                                         | 7.3457E-03              | 3.919E-04                             |
| 40.0             | 992.2164                               | -0.38248                                             | 0.000653                  | -1.227E-05                            | 6.5785E-07                              | -1.211E-08                                         | 7.3849E-03              | 3.937E-04                             |
| 40.1             | 992.1781                               | -0.38322                                             | 0.000652                  | -1.223E-05                            | 6.5664E-07                              | -1.208E-08                                         | 7.4244E-03              | 3.955E-04                             |
| 40.2             | 992.1397                               | -0.38397                                             | 0.000650                  | -1.220E-05                            | 6.5543E-07                              | -1.204E-08                                         | 7.4640E-03              | 3.974E-04                             |
| 40.3             | 992.1013                               | -0.38471                                             | 0.000649                  | -1.216E-05                            | 6.5423E-07                              | -1.200E-08                                         | 7.5039E-03              | 3.992E-04                             |
| 40.4             | 992.0628                               | -0.38545                                             | 0.000648                  | -1.212E-05                            | 6.5303E-07                              | -1.196E-08                                         | 7.5439E-03              | 4.010E-04                             |
| 40.5             | 992.0242                               | -0.38619                                             | 0.000647                  | -1.208E-05                            | 6.5184E-07                              | -1.193E-08                                         | 7.5841E-03              | 4.029E-04                             |
| 40.6             | 991.9855                               | -0.38693                                             | 0.000645                  | -1.205E-05                            | 6.5065E-07                              | -1.189E-08                                         | 7.6245E-03              | 4.047E-04                             |
| 40.7             | 991.9468                               | -0.38767                                             | 0.000644                  | -1.201E-05                            | 6.4946E-07                              | -1.185E-08                                         | 7.6650E-03              | 4.066E-04                             |
| 40.8             | 991.9080                               | -0.38841                                             | 0.000643                  | -1.197E-05                            | 6.4828E-07                              | -1.182E-08                                         | 7.7058E-03              | 4.084E-04                             |
| 40.9             | 991.8691                               | -0.38914                                             | 0.000642                  | -1.194E-05                            | 6.4710E-07                              | -1.178E-08                                         | 7.7467E-03              | 4.103E-04                             |
| 41.0             | 991.8302                               | -0.38988                                             | 0.000641                  | -1.190E-05                            | 6.4592E-07                              | -1.175E-08                                         | 7.7878E-03              | 4.122E-04                             |
| 41.1             | 991.7911                               | -0.39061                                             | 0.000639                  | -1.187E-05                            | 6.4475E-07                              | -1.171E-08                                         | 7.8292E-03              | 4.141E-04                             |
| 41.2             | 991.7520                               | -0.39135                                             | 0.000638                  | -1.183E-05                            | 6.4358E-07                              | -1.167E-08                                         | 7.8707E-03              | 4.160E-04                             |
| 41.3             | 991.7129                               | -0.39208                                             | 0.000637                  | -1.180E-05                            | 6.4241E-07                              | -1.164E-08                                         | 7.9123E-03              | 4.179E-04                             |
| 41.4             | 991.6736                               | -0.39281                                             | 0.000636                  | -1.176E-05                            | 6.4125E-07                              | -1.160E-08                                         | 7.9542E-03              | 4.198E-04                             |
| 41.5             | 991.6343                               | -0.39354                                             | 0.000635                  | -1.172E-05                            | 6.4009E-07                              | -1.157E-08                                         | 7.9963E-03              | 4.217E-04                             |
| 41.6             | 991.5949                               | -0.39427                                             | 0.000634                  | -1.169E-05                            | 6.3894E-07                              | -1.153E-08                                         | 8.0386E-03              | 4.236E-04                             |
| 41.7             | 991.5555                               | -0.39500                                             | 0.000632                  | -1.165E-05                            | 6.3779E-07                              | -1.150E-08                                         | 8.0810E-03              | 4.255E-04                             |
| 41.8             | 991.5159                               | -0.39573                                             | 0.000631                  | -1.162E-05                            | 6.3664E-07                              | -1.146E-08                                         | 8.1237E-03              | 4.275E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 41.9             | 991.4763                               | -0.39645                                             | 0.000630                  | -1.158E-05                            | 6.3549E-07                              | -1.143E-08                                         | 8.1665E-03              | 4.294E-04                             |
| 42.0             | 991.4366                               | -0.39718                                             | 0.000629                  | -1.155E-05                            | 6.3435E-07                              | -1.139E-08                                         | 8.2096E-03              | 4.314E-04                             |
| 42.1             | 991.3969                               | -0.39790                                             | 0.000628                  | -1.151E-05                            | 6.3321E-07                              | -1.136E-08                                         | 8.2528E-03              | 4.333E-04                             |
| 42.2             | 991.3571                               | -0.39863                                             | 0.000627                  | -1.148E-05                            | 6.3208E-07                              | -1.133E-08                                         | 8.2962E-03              | 4.353E-04                             |
| 42.3             | 991.3172                               | -0.39935                                             | 0.000625                  | -1.145E-05                            | 6.3095E-07                              | -1.129E-08                                         | 8.3399E-03              | 4.373E-04                             |
| 42.4             | 991.2772                               | -0.40007                                             | 0.000624                  | -1.141E-05                            | 6.2982E-07                              | -1.126E-08                                         | 8.3837E-03              | 4.393E-04                             |
| 42.5             | 991.2371                               | -0.40079                                             | 0.000623                  | -1.138E-05                            | 6.2870E-07                              | -1.122E-08                                         | 8.4277E-03              | 4.412E-04                             |
| 42.6             | 991.1970                               | -0.40151                                             | 0.000622                  | -1.134E-05                            | 6.2758E-07                              | -1.119E-08                                         | 8.4719E-03              | 4.432E-04                             |
| 42.7             | 991.1568                               | -0.40223                                             | 0.000621                  | -1.131E-05                            | 6.2646E-07                              | -1.116E-08                                         | 8.5164E-03              | 4.452E-04                             |
| 42.8             | 991.1166                               | -0.40295                                             | 0.000620                  | -1.128E-05                            | 6.2535E-07                              | -1.112E-08                                         | 8.5610E-03              | 4.472E-04                             |
| 42.9             | 991.0762                               | -0.40366                                             | 0.000619                  | -1.124E-05                            | 6.2423E-07                              | -1.109E-08                                         | 8.6058E-03              | 4.493E-04                             |
| 43.0             | 991.0358                               | -0.40438                                             | 0.000618                  | -1.121E-05                            | 6.2313E-07                              | -1.106E-08                                         | 8.6508E-03              | 4.513E-04                             |
| 43.1             | 990.9954                               | -0.40509                                             | 0.000616                  | -1.118E-05                            | 6.2202E-07                              | -1.102E-08                                         | 8.6961E-03              | 4.533E-04                             |
| 43.2             | 990.9548                               | -0.40581                                             | 0.000615                  | -1.114E-05                            | 6.2092E-07                              | -1.099E-08                                         | 8.7415E-03              | 4.554E-04                             |
| 43.3             | 990.9142                               | -0.40652                                             | 0.000614                  | -1.111E-05                            | 6.1982E-07                              | -1.096E-08                                         | 8.7871E-03              | 4.574E-04                             |
| 43.4             | 990.8735                               | -0.40723                                             | 0.000613                  | -1.108E-05                            | 6.1873E-07                              | -1.093E-08                                         | 8.8330E-03              | 4.595E-04                             |
| 43.5             | 990.8328                               | -0.40794                                             | 0.000612                  | -1.105E-05                            | 6.1764E-07                              | -1.089E-08                                         | 8.8790E-03              | 4.615E-04                             |
| 43.6             | 990.7919                               | -0.40866                                             | 0.000611                  | -1.101E-05                            | 6.1655E-07                              | -1.086E-08                                         | 8.9253E-03              | 4.636E-04                             |
| 43.7             | 990.7510                               | -0.40936                                             | 0.000610                  | -1.098E-05                            | 6.1547E-07                              | -1.083E-08                                         | 8.9717E-03              | 4.657E-04                             |
| 43.8             | 990.7101                               | -0.41007                                             | 0.000609                  | -1.095E-05                            | 6.1439E-07                              | -1.080E-08                                         | 9.0184E-03              | 4.678E-04                             |
| 43.9             | 990.6690                               | -0.41078                                             | 0.000608                  | -1.092E-05                            | 6.1331E-07                              | -1.076E-08                                         | 9.0653E-03              | 4.699E-04                             |
| 44.0             | 990.6279                               | -0.41149                                             | 0.000606                  | -1.088E-05                            | 6.1223E-07                              | -1.073E-08                                         | 9.1124E-03              | 4.720E-04                             |
| 44.1             | 990.5867                               | -0.41219                                             | 0.000605                  | -1.085E-05                            | 6.1116E-07                              | -1.070E-08                                         | 9.1597E-03              | 4.741E-04                             |
| 44.2             | 990.5455                               | -0.41290                                             | 0.000604                  | -1.082E-05                            | 6.1009E-07                              | -1.067E-08                                         | 9.2072E-03              | 4.762E-04                             |
| 44.3             | 990.5041                               | -0.41360                                             | 0.000603                  | -1.079E-05                            | 6.0903E-07                              | -1.064E-08                                         | 9.2549E-03              | 4.783E-04                             |
| 44.4             | 990.4627                               | -0.41430                                             | 0.000602                  | -1.076E-05                            | 6.0797E-07                              | -1.061E-08                                         | 9.3029E-03              | 4.804E-04                             |
| 44.5             | 990.4213                               | -0.41501                                             | 0.000601                  | -1.073E-05                            | 6.0691E-07                              | -1.058E-08                                         | 9.3510E-03              | 4.826E-04                             |
| 44.6             | 990.3797                               | -0.41571                                             | 0.000600                  | -1.069E-05                            | 6.0585E-07                              | -1.054E-08                                         | 9.3994E-03              | 4.847E-04                             |
| 44.7             | 990.3381                               | -0.41641                                             | 0.000599                  | -1.066E-05                            | 6.0480E-07                              | -1.051E-08                                         | 9.4480E-03              | 4.869E-04                             |
| 44.8             | 990.2965                               | -0.41711                                             | 0.000598                  | -1.063E-05                            | 6.0375E-07                              | -1.048E-08                                         | 9.4968E-03              | 4.890E-04                             |
| 44.9             | 990.2547                               | -0.41780                                             | 0.000597                  | -1.060E-05                            | 6.0270E-07                              | -1.045E-08                                         | 9.5458E-03              | 4.912E-04                             |
| 45.0             | 990.2129                               | -0.41850                                             | 0.000596                  | -1.057E-05                            | 6.0166E-07                              | -1.042E-08                                         | 9.5950E-03              | 4.934E-04                             |
| 45.1             | 990.1710                               | -0.41920                                             | 0.000595                  | -1.054E-05                            | 6.0062E-07                              | -1.039E-08                                         | 9.6444E-03              | 4.956E-04                             |
| 45.2             | 990.1291                               | -0.41989                                             | 0.000594                  | -1.051E-05                            | 5.9958E-07                              | -1.036E-08                                         | 9.6941E-03              | 4.978E-04                             |
| 45.3             | 990.0870                               | -0.42059                                             | 0.000593                  | -1.048E-05                            | 5.9855E-07                              | -1.033E-08                                         | 9.7440E-03              | 5.000E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 45.4             | 990.0449                               | -0.42128                                             | 0.000592                  | -1.045E-05                            | 5.9751E-07                              | -1.030E-08                                         | 9.7941E-03              | 5.022E-04                             |
| 45.5             | 990.0028                               | -0.42198                                             | 0.000591                  | -1.042E-05                            | 5.9649E-07                              | -1.027E-08                                         | 9.8444E-03              | 5.044E-04                             |
| 45.6             | 989.9606                               | -0.42267                                             | 0.000589                  | -1.039E-05                            | 5.9546E-07                              | -1.024E-08                                         | 9.8950E-03              | 5.066E-04                             |
| 45.7             | 989.9182                               | -0.42336                                             | 0.000588                  | -1.036E-05                            | 5.9444E-07                              | -1.021E-08                                         | 9.9458E-03              | 5.089E-04                             |
| 45.8             | 989.8759                               | -0.42405                                             | 0.000587                  | -1.033E-05                            | 5.9342E-07                              | -1.018E-08                                         | 9.9968E-03              | 5.111E-04                             |
| 45.9             | 989.8334                               | -0.42474                                             | 0.000586                  | -1.030E-05                            | 5.9240E-07                              | -1.015E-08                                         | 1.0048E-02              | 5.134E-04                             |
| 46.0             | 989.7909                               | -0.42543                                             | 0.000585                  | -1.027E-05                            | 5.9139E-07                              | -1.012E-08                                         | 1.0099E-02              | 5.156E-04                             |
| 46.1             | 989.7484                               | -0.42612                                             | 0.000584                  | -1.024E-05                            | 5.9038E-07                              | -1.009E-08                                         | 1.0151E-02              | 5.179E-04                             |
| 46.2             | 989.7057                               | -0.42680                                             | 0.000583                  | -1.021E-05                            | 5.8937E-07                              | -1.006E-08                                         | 1.0203E-02              | 5.202E-04                             |
| 46.3             | 989.6630                               | -0.42749                                             | 0.000582                  | -1.018E-05                            | 5.8836E-07                              | -1.003E-08                                         | 1.0255E-02              | 5.225E-04                             |
| 46.4             | 989.6202                               | -0.42817                                             | 0.000581                  | -1.015E-05                            | 5.8736E-07                              | -1.000E-08                                         | 1.0308E-02              | 5.247E-04                             |
| 46.5             | 989.5774                               | -0.42886                                             | 0.000580                  | -1.012E-05                            | 5.8636E-07                              | -9.976E-09                                         | 1.0360E-02              | 5.270E-04                             |
| 46.6             | 989.5344                               | -0.42954                                             | 0.000579                  | -1.010E-05                            | 5.8537E-07                              | -9.948E-09                                         | 1.0413E-02              | 5.294E-04                             |
| 46.7             | 989.4915                               | -0.43022                                             | 0.000578                  | -1.007E-05                            | 5.8437E-07                              | -9.918E-09                                         | 1.0466E-02              | 5.317E-04                             |
| 46.8             | 989.4484                               | -0.43091                                             | 0.000577                  | -1.004E-05                            | 5.8338E-07                              | -9.890E-09                                         | 1.0519E-02              | 5.340E-04                             |
| 46.9             | 989.4053                               | -0.43159                                             | 0.000576                  | -1.001E-05                            | 5.8240E-07                              | -9.862E-09                                         | 1.0573E-02              | 5.363E-04                             |
| 47.0             | 989.3621                               | -0.43227                                             | 0.000575                  | -9.981E-06                            | 5.8141E-07                              | -9.834E-09                                         | 1.0627E-02              | 5.387E-04                             |
| 47.1             | 989.3188                               | -0.43295                                             | 0.000574                  | -9.951E-06                            | 5.8043E-07                              | -9.805E-09                                         | 1.0680E-02              | 5.410E-04                             |
| 47.2             | 989.2755                               | -0.43363                                             | 0.000573                  | -9.924E-06                            | 5.7945E-07                              | -9.777E-09                                         | 1.0735E-02              | 5.434E-04                             |
| 47.3             | 989.2321                               | -0.43430                                             | 0.000572                  | -9.895E-06                            | 5.7847E-07                              | -9.749E-09                                         | 1.0789E-02              | 5.457E-04                             |
| 47.4             | 989.1886                               | -0.43498                                             | 0.000571                  | -9.868E-06                            | 5.7750E-07                              | -9.721E-09                                         | 1.0844E-02              | 5.481E-04                             |
| 47.5             | 989.1451                               | -0.43566                                             | 0.000570                  | -9.840E-06                            | 5.7653E-07                              | -9.694E-09                                         | 1.0899E-02              | 5.505E-04                             |
| 47.6             | 989.1015                               | -0.43633                                             | 0.000569                  | -9.811E-06                            | 5.7556E-07                              | -9.666E-09                                         | 1.0954E-02              | 5.529E-04                             |
| 47.7             | 989.0578                               | -0.43701                                             | 0.000568                  | -9.784E-06                            | 5.7460E-07                              | -9.638E-09                                         | 1.1009E-02              | 5.553E-04                             |
| 47.8             | 989.0141                               | -0.43768                                             | 0.000567                  | -9.757E-06                            | 5.7363E-07                              | -9.611E-09                                         | 1.1065E-02              | 5.577E-04                             |
| 47.9             | 988.9703                               | -0.43835                                             | 0.000566                  | -9.729E-06                            | 5.7267E-07                              | -9.584E-09                                         | 1.1121E-02              | 5.601E-04                             |
| 48.0             | 988.9264                               | -0.43902                                             | 0.000565                  | -9.701E-06                            | 5.7172E-07                              | -9.556E-09                                         | 1.1177E-02              | 5.626E-04                             |
| 48.1             | 988.8825                               | -0.43970                                             | 0.000564                  | -9.674E-06                            | 5.7076E-07                              | -9.529E-09                                         | 1.1233E-02              | 5.650E-04                             |
| 48.2             | 988.8385                               | -0.44037                                             | 0.000563                  | -9.647E-06                            | 5.6981E-07                              | -9.502E-09                                         | 1.1290E-02              | 5.674E-04                             |
| 48.3             | 988.7944                               | -0.44103                                             | 0.000562                  | -9.620E-06                            | 5.6886E-07                              | -9.475E-09                                         | 1.1347E-02              | 5.699E-04                             |
| 48.4             | 988.7503                               | -0.44170                                             | 0.000562                  | -9.593E-06                            | 5.6792E-07                              | -9.448E-09                                         | 1.1404E-02              | 5.723E-04                             |
| 48.5             | 988.7061                               | -0.44237                                             | 0.000561                  | -9.566E-06                            | 5.6697E-07                              | -9.422E-09                                         | 1.1461E-02              | 5.748E-04                             |
| 48.6             | 988.6618                               | -0.44304                                             | 0.000560                  | -9.539E-06                            | 5.6603E-07                              | -9.395E-09                                         | 1.1519E-02              | 5.773E-04                             |
| 48.7             | 988.6175                               | -0.44371                                             | 0.000559                  | -9.513E-06                            | 5.6509E-07                              | -9.368E-09                                         | 1.1577E-02              | 5.798E-04                             |
| 48.8             | 988.5731                               | -0.44437                                             | 0.000558                  | -9.486E-06                            | 5.6416E-07                              | -9.342E-09                                         | 1.1635E-02              | 5.823E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscosity $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|---------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 48.9             | 988.5286                               | -0.44504                                             | 0.000557                  | -9.459E-06                            | 5.6323E-07                              | -9.316E-09                                         | 1.1693E-02              | 5.848E-04                             |
| 49.0             | 988.4841                               | -0.44570                                             | 0.000556                  | -9.433E-06                            | 5.6229E-07                              | -9.289E-09                                         | 1.1752E-02              | 5.873E-04                             |
| 49.1             | 988.4395                               | -0.44636                                             | 0.000555                  | -9.407E-06                            | 5.6137E-07                              | -9.264E-09                                         | 1.1811E-02              | 5.898E-04                             |
| 49.2             | 988.3948                               | -0.44703                                             | 0.000554                  | -9.381E-06                            | 5.6044E-07                              | -9.238E-09                                         | 1.1870E-02              | 5.924E-04                             |
| 49.3             | 988.3500                               | -0.44769                                             | 0.000553                  | -9.355E-06                            | 5.5952E-07                              | -9.212E-09                                         | 1.1929E-02              | 5.949E-04                             |
| 49.4             | 988.3052                               | -0.44835                                             | 0.000552                  | -9.329E-06                            | 5.5860E-07                              | -9.186E-09                                         | 1.1989E-02              | 5.974E-04                             |
| 49.5             | 988.2604                               | -0.44901                                             | 0.000551                  | -9.303E-06                            | 5.5768E-07                              | -9.160E-09                                         | 1.2049E-02              | 6.000E-04                             |
| 49.6             | 988.2154                               | -0.44967                                             | 0.000550                  | -9.277E-06                            | 5.5677E-07                              | -9.134E-09                                         | 1.2109E-02              | 6.026E-04                             |
| 49.7             | 988.1704                               | -0.45033                                             | 0.000549                  | -9.252E-06                            | 5.5586E-07                              | -9.109E-09                                         | 1.2169E-02              | 6.051E-04                             |
| 49.8             | 988.1254                               | -0.45098                                             | 0.000548                  | -9.226E-06                            | 5.5495E-07                              | -9.084E-09                                         | 1.2230E-02              | 6.077E-04                             |
| 49.9             | 988.0802                               | -0.45164                                             | 0.000547                  | -9.200E-06                            | 5.5404E-07                              | -9.058E-09                                         | 1.2291E-02              | 6.103E-04                             |
| 50.0             | 988.0351                               | -0.45230                                             | 0.000547                  |                                       | 5.5313E-07                              |                                                    | 1.2352E-02              |                                       |

**Appendix B: Standard Saltwater Properties 0.1 to 50 °C in 0.1 °C Increments**

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 0.1              | 1028.1499                              |                                                      | 0.001900               |                                       | 1.8480E-06                              |                                                    | 6.0306E-04              |                                       |
| 0.2              | 1028.1442                              | -0.0575                                              | 0.001894               | -6.462E-05                            | 1.8417E-06                              | -6.275E-08                                         | 6.0745E-04              | 4.407E-05                             |
| 0.3              | 1028.1384                              | -0.0585                                              | 0.001887               | -6.427E-05                            | 1.8354E-06                              | -6.240E-08                                         | 6.1187E-04              | 4.436E-05                             |
| 0.4              | 1028.1325                              | -0.0600                                              | 0.001881               | -6.391E-05                            | 1.8292E-06                              | -6.206E-08                                         | 6.1632E-04              | 4.464E-05                             |
| 0.5              | 1028.1264                              | -0.0615                                              | 0.001874               | -6.356E-05                            | 1.8230E-06                              | -6.172E-08                                         | 6.2080E-04              | 4.493E-05                             |
| 0.6              | 1028.1202                              | -0.0625                                              | 0.001868               | -6.322E-05                            | 1.8169E-06                              | -6.138E-08                                         | 6.2531E-04              | 4.522E-05                             |
| 0.7              | 1028.1139                              | -0.0640                                              | 0.001862               | -6.287E-05                            | 1.8107E-06                              | -6.104E-08                                         | 6.2985E-04              | 4.551E-05                             |
| 0.8              | 1028.1074                              | -0.0655                                              | 0.001855               | -6.253E-05                            | 1.8047E-06                              | -6.071E-08                                         | 6.3441E-04              | 4.580E-05                             |
| 0.9              | 1028.1008                              | -0.0665                                              | 0.001849               | -6.219E-05                            | 1.7986E-06                              | -6.038E-08                                         | 6.3901E-04              | 4.609E-05                             |
| 1.0              | 1028.0941                              | -0.0680                                              | 0.001843               | -6.186E-05                            | 1.7926E-06                              | -6.005E-08                                         | 6.4363E-04              | 4.639E-05                             |
| 1.1              | 1028.0872                              | -0.0695                                              | 0.001837               | -6.152E-05                            | 1.7866E-06                              | -5.972E-08                                         | 6.4828E-04              | 4.669E-05                             |
| 1.2              | 1028.0802                              | -0.0705                                              | 0.001831               | -6.119E-05                            | 1.7806E-06                              | -5.940E-08                                         | 6.5297E-04              | 4.699E-05                             |
| 1.3              | 1028.0731                              | -0.0720                                              | 0.001825               | -6.086E-05                            | 1.7747E-06                              | -5.907E-08                                         | 6.5768E-04              | 4.729E-05                             |
| 1.4              | 1028.0658                              | -0.0730                                              | 0.001818               | -6.053E-05                            | 1.7688E-06                              | -5.876E-08                                         | 6.6243E-04              | 4.759E-05                             |
| 1.5              | 1028.0585                              | -0.0740                                              | 0.001812               | -6.021E-05                            | 1.7630E-06                              | -5.844E-08                                         | 6.6720E-04              | 4.789E-05                             |
| 1.6              | 1028.0510                              | -0.0760                                              | 0.001806               | -5.989E-05                            | 1.7571E-06                              | -5.812E-08                                         | 6.7200E-04              | 4.820E-05                             |
| 1.7              | 1028.0433                              | -0.0770                                              | 0.001800               | -5.957E-05                            | 1.7513E-06                              | -5.781E-08                                         | 6.7684E-04              | 4.850E-05                             |
| 1.8              | 1028.0356                              | -0.0780                                              | 0.001795               | -5.925E-05                            | 1.7456E-06                              | -5.750E-08                                         | 6.8170E-04              | 4.881E-05                             |
| 1.9              | 1028.0277                              | -0.0795                                              | 0.001789               | -5.893E-05                            | 1.7398E-06                              | -5.719E-08                                         | 6.8660E-04              | 4.912E-05                             |
| 2.0              | 1028.0197                              | -0.0810                                              | 0.001783               | -5.862E-05                            | 1.7341E-06                              | -5.689E-08                                         | 6.9153E-04              | 4.944E-05                             |
| 2.1              | 1028.0115                              | -0.0820                                              | 0.001777               | -5.831E-05                            | 1.7285E-06                              | -5.658E-08                                         | 6.9649E-04              | 4.975E-05                             |
| 2.2              | 1028.0033                              | -0.0830                                              | 0.001771               | -5.800E-05                            | 1.7228E-06                              | -5.628E-08                                         | 7.0148E-04              | 5.006E-05                             |
| 2.3              | 1027.9949                              | -0.0845                                              | 0.001765               | -5.770E-05                            | 1.7172E-06                              | -5.598E-08                                         | 7.0650E-04              | 5.038E-05                             |
| 2.4              | 1027.9864                              | -0.0855                                              | 0.001760               | -5.739E-05                            | 1.7116E-06                              | -5.569E-08                                         | 7.1156E-04              | 5.070E-05                             |
| 2.5              | 1027.9778                              | -0.0870                                              | 0.001754               | -5.709E-05                            | 1.7061E-06                              | -5.539E-08                                         | 7.1664E-04              | 5.102E-05                             |
| 2.6              | 1027.9690                              | -0.0885                                              | 0.001748               | -5.679E-05                            | 1.7005E-06                              | -5.510E-08                                         | 7.2176E-04              | 5.134E-05                             |
| 2.7              | 1027.9601                              | -0.0895                                              | 0.001742               | -5.649E-05                            | 1.6950E-06                              | -5.481E-08                                         | 7.2691E-04              | 5.167E-05                             |
| 2.8              | 1027.9511                              | -0.0905                                              | 0.001737               | -5.620E-05                            | 1.6896E-06                              | -5.452E-08                                         | 7.3209E-04              | 5.199E-05                             |
| 2.9              | 1027.9420                              | -0.0920                                              | 0.001731               | -5.591E-05                            | 1.6841E-06                              | -5.424E-08                                         | 7.3731E-04              | 5.232E-05                             |
| 3.0              | 1027.9327                              | -0.0930                                              | 0.001726               | -5.561E-05                            | 1.6787E-06                              | -5.395E-08                                         | 7.4256E-04              | 5.265E-05                             |
| 3.1              | 1027.9234                              | -0.0940                                              | 0.001720               | -5.533E-05                            | 1.6734E-06                              | -5.367E-08                                         | 7.4784E-04              | 5.298E-05                             |
| 3.2              | 1027.9139                              | -0.0960                                              | 0.001715               | -5.504E-05                            | 1.6680E-06                              | -5.339E-08                                         | 7.5315E-04              | 5.331E-05                             |



| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 3.3              | 1027.9042                              | -0.0970                                              | 0.001709               | -5.475E-05                            | 1.6627E-06                              | -5.311E-08                                         | 7.5850E-04              | 5.365E-05                             |
| 3.4              | 1027.8945                              | -0.0980                                              | 0.001704               | -5.447E-05                            | 1.6574E-06                              | -5.283E-08                                         | 7.6388E-04              | 5.399E-05                             |
| 3.5              | 1027.8846                              | -0.0990                                              | 0.001698               | -5.419E-05                            | 1.6521E-06                              | -5.256E-08                                         | 7.6930E-04              | 5.432E-05                             |
| 3.6              | 1027.8747                              | -0.1000                                              | 0.001693               | -5.391E-05                            | 1.6469E-06                              | -5.229E-08                                         | 7.7475E-04              | 5.466E-05                             |
| 3.7              | 1027.8646                              | -0.1015                                              | 0.001687               | -5.364E-05                            | 1.6416E-06                              | -5.202E-08                                         | 7.8023E-04              | 5.501E-05                             |
| 3.8              | 1027.8544                              | -0.1030                                              | 0.001682               | -5.336E-05                            | 1.6365E-06                              | -5.175E-08                                         | 7.8575E-04              | 5.535E-05                             |
| 3.9              | 1027.8440                              | -0.1040                                              | 0.001677               | -5.309E-05                            | 1.6313E-06                              | -5.148E-08                                         | 7.9130E-04              | 5.570E-05                             |
| 4.0              | 1027.8336                              | -0.1050                                              | 0.001671               | -5.282E-05                            | 1.6262E-06                              | -5.122E-08                                         | 7.9689E-04              | 5.604E-05                             |
| 4.1              | 1027.8230                              | -0.1065                                              | 0.001666               | -5.255E-05                            | 1.6211E-06                              | -5.096E-08                                         | 8.0251E-04              | 5.639E-05                             |
| 4.2              | 1027.8123                              | -0.1075                                              | 0.001661               | -5.228E-05                            | 1.6160E-06                              | -5.070E-08                                         | 8.0817E-04              | 5.675E-05                             |
| 4.3              | 1027.8015                              | -0.1085                                              | 0.001656               | -5.201E-05                            | 1.6109E-06                              | -5.044E-08                                         | 8.1386E-04              | 5.710E-05                             |
| 4.4              | 1027.7906                              | -0.1100                                              | 0.001651               | -5.175E-05                            | 1.6059E-06                              | -5.018E-08                                         | 8.1959E-04              | 5.745E-05                             |
| 4.5              | 1027.7795                              | -0.1110                                              | 0.001645               | -5.149E-05                            | 1.6009E-06                              | -4.992E-08                                         | 8.2535E-04              | 5.781E-05                             |
| 4.6              | 1027.7684                              | -0.1120                                              | 0.001640               | -5.123E-05                            | 1.5959E-06                              | -4.967E-08                                         | 8.3115E-04              | 5.817E-05                             |
| 4.7              | 1027.7571                              | -0.1135                                              | 0.001635               | -5.097E-05                            | 1.5909E-06                              | -4.942E-08                                         | 8.3699E-04              | 5.853E-05                             |
| 4.8              | 1027.7457                              | -0.1145                                              | 0.001630               | -5.071E-05                            | 1.5860E-06                              | -4.917E-08                                         | 8.4286E-04              | 5.889E-05                             |
| 4.9              | 1027.7342                              | -0.1160                                              | 0.001625               | -5.046E-05                            | 1.5811E-06                              | -4.892E-08                                         | 8.4876E-04              | 5.926E-05                             |
| 5.0              | 1027.7225                              | -0.1170                                              | 0.001620               | -5.021E-05                            | 1.5762E-06                              | -4.867E-08                                         | 8.5471E-04              | 5.962E-05                             |
| 5.1              | 1027.7108                              | -0.1180                                              | 0.001615               | -4.996E-05                            | 1.5714E-06                              | -4.843E-08                                         | 8.6069E-04              | 5.999E-05                             |
| 5.2              | 1027.6989                              | -0.1190                                              | 0.001610               | -4.971E-05                            | 1.5665E-06                              | -4.818E-08                                         | 8.6671E-04              | 6.036E-05                             |
| 5.3              | 1027.6870                              | -0.1200                                              | 0.001605               | -4.946E-05                            | 1.5617E-06                              | -4.794E-08                                         | 8.7276E-04              | 6.074E-05                             |
| 5.4              | 1027.6749                              | -0.1215                                              | 0.001600               | -4.921E-05                            | 1.5570E-06                              | -4.770E-08                                         | 8.7885E-04              | 6.111E-05                             |
| 5.5              | 1027.6627                              | -0.1225                                              | 0.001595               | -4.897E-05                            | 1.5522E-06                              | -4.746E-08                                         | 8.8498E-04              | 6.149E-05                             |
| 5.6              | 1027.6504                              | -0.1240                                              | 0.001590               | -4.873E-05                            | 1.5475E-06                              | -4.723E-08                                         | 8.9115E-04              | 6.186E-05                             |
| 5.7              | 1027.6379                              | -0.1250                                              | 0.001585               | -4.848E-05                            | 1.5428E-06                              | -4.699E-08                                         | 8.9736E-04              | 6.225E-05                             |
| 5.8              | 1027.6254                              | -0.1260                                              | 0.001581               | -4.824E-05                            | 1.5381E-06                              | -4.676E-08                                         | 9.0360E-04              | 6.263E-05                             |
| 5.9              | 1027.6127                              | -0.1270                                              | 0.001576               | -4.801E-05                            | 1.5334E-06                              | -4.653E-08                                         | 9.0988E-04              | 6.301E-05                             |
| 6.0              | 1027.6000                              | -0.1280                                              | 0.001571               | -4.777E-05                            | 1.5288E-06                              | -4.630E-08                                         | 9.1620E-04              | 6.340E-05                             |
| 6.1              | 1027.5871                              | -0.1295                                              | 0.001566               | -4.754E-05                            | 1.5241E-06                              | -4.607E-08                                         | 9.2256E-04              | 6.379E-05                             |
| 6.2              | 1027.5741                              | -0.1305                                              | 0.001561               | -4.730E-05                            | 1.5195E-06                              | -4.584E-08                                         | 9.2896E-04              | 6.418E-05                             |
| 6.3              | 1027.5610                              | -0.1315                                              | 0.001557               | -4.707E-05                            | 1.5150E-06                              | -4.562E-08                                         | 9.3540E-04              | 6.457E-05                             |
| 6.4              | 1027.5478                              | -0.1330                                              | 0.001552               | -4.684E-05                            | 1.5104E-06                              | -4.539E-08                                         | 9.4187E-04              | 6.496E-05                             |
| 6.5              | 1027.5344                              | -0.1340                                              | 0.001547               | -4.661E-05                            | 1.5059E-06                              | -4.517E-08                                         | 9.4839E-04              | 6.536E-05                             |
| 6.6              | 1027.5210                              | -0.1345                                              | 0.001543               | -4.639E-05                            | 1.5014E-06                              | -4.495E-08                                         | 9.5495E-04              | 6.576E-05                             |
| 6.7              | 1027.5075                              | -0.1360                                              | 0.001538               | -4.616E-05                            | 1.4969E-06                              | -4.473E-08                                         | 9.6154E-04              | 6.616E-05                             |



| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 6.8              | 1027.4938                              | -0.1375                                              | 0.001533               | -4.594E-05                            | 1.4924E-06                              | -4.451E-08                                         | 9.6818E-04              | 6.656E-05                             |
| 6.9              | 1027.4800                              | -0.1380                                              | 0.001529               | -4.572E-05                            | 1.4880E-06                              | -4.429E-08                                         | 9.7485E-04              | 6.697E-05                             |
| 7.0              | 1027.4662                              | -0.1390                                              | 0.001524               | -4.549E-05                            | 1.4836E-06                              | -4.408E-08                                         | 9.8157E-04              | 6.738E-05                             |
| 7.1              | 1027.4522                              | -0.1405                                              | 0.001520               | -4.528E-05                            | 1.4792E-06                              | -4.386E-08                                         | 9.8833E-04              | 6.779E-05                             |
| 7.2              | 1027.4381                              | -0.1415                                              | 0.001515               | -4.506E-05                            | 1.4748E-06                              | -4.365E-08                                         | 9.9513E-04              | 6.820E-05                             |
| 7.3              | 1027.4239                              | -0.1430                                              | 0.001511               | -4.484E-05                            | 1.4705E-06                              | -4.344E-08                                         | 1.0020E-03              | 6.861E-05                             |
| 7.4              | 1027.4095                              | -0.1440                                              | 0.001506               | -4.463E-05                            | 1.4661E-06                              | -4.323E-08                                         | 1.0089E-03              | 6.903E-05                             |
| 7.5              | 1027.3951                              | -0.1445                                              | 0.001502               | -4.441E-05                            | 1.4618E-06                              | -4.302E-08                                         | 1.0158E-03              | 6.944E-05                             |
| 7.6              | 1027.3806                              | -0.1460                                              | 0.001497               | -4.420E-05                            | 1.4575E-06                              | -4.281E-08                                         | 1.0227E-03              | 6.986E-05                             |
| 7.7              | 1027.3659                              | -0.1470                                              | 0.001493               | -4.399E-05                            | 1.4533E-06                              | -4.261E-08                                         | 1.0297E-03              | 7.029E-05                             |
| 7.8              | 1027.3512                              | -0.1480                                              | 0.001489               | -4.378E-05                            | 1.4490E-06                              | -4.241E-08                                         | 1.0368E-03              | 7.071E-05                             |
| 7.9              | 1027.3363                              | -0.1490                                              | 0.001484               | -4.357E-05                            | 1.4448E-06                              | -4.220E-08                                         | 1.0439E-03              | 7.114E-05                             |
| 8.0              | 1027.3214                              | -0.1500                                              | 0.001480               | -4.337E-05                            | 1.4406E-06                              | -4.200E-08                                         | 1.0510E-03              | 7.156E-05                             |
| 8.1              | 1027.3063                              | -0.1515                                              | 0.001476               | -4.316E-05                            | 1.4364E-06                              | -4.180E-08                                         | 1.0582E-03              | 7.200E-05                             |
| 8.2              | 1027.2911                              | -0.1525                                              | 0.001471               | -4.296E-05                            | 1.4322E-06                              | -4.160E-08                                         | 1.0654E-03              | 7.243E-05                             |
| 8.3              | 1027.2758                              | -0.1530                                              | 0.001467               | -4.275E-05                            | 1.4280E-06                              | -4.141E-08                                         | 1.0727E-03              | 7.286E-05                             |
| 8.4              | 1027.2605                              | -0.1540                                              | 0.001463               | -4.255E-05                            | 1.4239E-06                              | -4.121E-08                                         | 1.0800E-03              | 7.330E-05                             |
| 8.5              | 1027.2450                              | -0.1555                                              | 0.001458               | -4.235E-05                            | 1.4198E-06                              | -4.101E-08                                         | 1.0873E-03              | 7.374E-05                             |
| 8.6              | 1027.2294                              | -0.1570                                              | 0.001454               | -4.215E-05                            | 1.4157E-06                              | -4.082E-08                                         | 1.0947E-03              | 7.418E-05                             |
| 8.7              | 1027.2136                              | -0.1580                                              | 0.001450               | -4.196E-05                            | 1.4116E-06                              | -4.063E-08                                         | 1.1022E-03              | 7.463E-05                             |
| 8.8              | 1027.1978                              | -0.1585                                              | 0.001446               | -4.176E-05                            | 1.4076E-06                              | -4.044E-08                                         | 1.1097E-03              | 7.507E-05                             |
| 8.9              | 1027.1819                              | -0.1595                                              | 0.001442               | -4.156E-05                            | 1.4036E-06                              | -4.025E-08                                         | 1.1172E-03              | 7.552E-05                             |
| 9.0              | 1027.1659                              | -0.1605                                              | 0.001438               | -4.137E-05                            | 1.3995E-06                              | -4.006E-08                                         | 1.1248E-03              | 7.597E-05                             |
| 9.1              | 1027.1498                              | -0.1620                                              | 0.001433               | -4.118E-05                            | 1.3955E-06                              | -3.987E-08                                         | 1.1324E-03              | 7.643E-05                             |
| 9.2              | 1027.1335                              | -0.1630                                              | 0.001429               | -4.099E-05                            | 1.3916E-06                              | -3.968E-08                                         | 1.1401E-03              | 7.688E-05                             |
| 9.3              | 1027.1172                              | -0.1635                                              | 0.001425               | -4.080E-05                            | 1.3876E-06                              | -3.950E-08                                         | 1.1478E-03              | 7.734E-05                             |
| 9.4              | 1027.1008                              | -0.1650                                              | 0.001421               | -4.061E-05                            | 1.3837E-06                              | -3.931E-08                                         | 1.1555E-03              | 7.780E-05                             |
| 9.5              | 1027.0842                              | -0.1660                                              | 0.001417               | -4.042E-05                            | 1.3797E-06                              | -3.913E-08                                         | 1.1633E-03              | 7.827E-05                             |
| 9.6              | 1027.0676                              | -0.1670                                              | 0.001413               | -4.023E-05                            | 1.3758E-06                              | -3.895E-08                                         | 1.1712E-03              | 7.873E-05                             |
| 9.7              | 1027.0508                              | -0.1680                                              | 0.001409               | -4.005E-05                            | 1.3720E-06                              | -3.877E-08                                         | 1.1791E-03              | 7.920E-05                             |
| 9.8              | 1027.0340                              | -0.1690                                              | 0.001405               | -3.987E-05                            | 1.3681E-06                              | -3.859E-08                                         | 1.1870E-03              | 7.967E-05                             |
| 9.9              | 1027.0170                              | -0.1700                                              | 0.001401               | -3.968E-05                            | 1.3642E-06                              | -3.841E-08                                         | 1.1950E-03              | 8.014E-05                             |
| 10.0             | 1027.0000                              | -0.1710                                              | 0.001397               | -3.950E-05                            | 1.3604E-06                              | -3.823E-08                                         | 1.2030E-03              | 8.061E-05                             |
| 10.1             | 1026.9828                              | -0.1725                                              | 0.001393               | -3.932E-05                            | 1.3566E-06                              | -3.806E-08                                         | 1.2111E-03              | 8.109E-05                             |
| 10.2             | 1026.9655                              | -0.1730                                              | 0.001389               | -3.914E-05                            | 1.3528E-06                              | -3.788E-08                                         | 1.2193E-03              | 8.157E-05                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 10.3             | 1026.9482                              | -0.1740                                              | 0.001385               | -3.896E-05                            | 1.3490E-06                              | -3.771E-08                                         | 1.2274E-03              | 8.205E-05                             |
| 10.4             | 1026.9307                              | -0.1755                                              | 0.001381               | -3.878E-05                            | 1.3453E-06                              | -3.754E-08                                         | 1.2357E-03              | 8.254E-05                             |
| 10.5             | 1026.9131                              | -0.1760                                              | 0.001378               | -3.861E-05                            | 1.3415E-06                              | -3.737E-08                                         | 1.2440E-03              | 8.302E-05                             |
| 10.6             | 1026.8955                              | -0.1770                                              | 0.001374               | -3.843E-05                            | 1.3378E-06                              | -3.720E-08                                         | 1.2523E-03              | 8.351E-05                             |
| 10.7             | 1026.8777                              | -0.1785                                              | 0.001370               | -3.826E-05                            | 1.3341E-06                              | -3.703E-08                                         | 1.2607E-03              | 8.401E-05                             |
| 10.8             | 1026.8598                              | -0.1790                                              | 0.001366               | -3.809E-05                            | 1.3304E-06                              | -3.686E-08                                         | 1.2691E-03              | 8.450E-05                             |
| 10.9             | 1026.8419                              | -0.1800                                              | 0.001362               | -3.791E-05                            | 1.3267E-06                              | -3.669E-08                                         | 1.2776E-03              | 8.500E-05                             |
| 11.0             | 1026.8238                              | -0.1815                                              | 0.001359               | -3.774E-05                            | 1.3230E-06                              | -3.652E-08                                         | 1.2861E-03              | 8.550E-05                             |
| 11.1             | 1026.8056                              | -0.1825                                              | 0.001355               | -3.757E-05                            | 1.3194E-06                              | -3.636E-08                                         | 1.2947E-03              | 8.600E-05                             |
| 11.2             | 1026.7873                              | -0.1830                                              | 0.001351               | -3.741E-05                            | 1.3158E-06                              | -3.620E-08                                         | 1.3033E-03              | 8.650E-05                             |
| 11.3             | 1026.7690                              | -0.1840                                              | 0.001347               | -3.724E-05                            | 1.3122E-06                              | -3.603E-08                                         | 1.3120E-03              | 8.701E-05                             |
| 11.4             | 1026.7505                              | -0.1855                                              | 0.001344               | -3.707E-05                            | 1.3086E-06                              | -3.587E-08                                         | 1.3207E-03              | 8.752E-05                             |
| 11.5             | 1026.7319                              | -0.1860                                              | 0.001340               | -3.691E-05                            | 1.3050E-06                              | -3.571E-08                                         | 1.3295E-03              | 8.803E-05                             |
| 11.6             | 1026.7133                              | -0.1870                                              | 0.001336               | -3.674E-05                            | 1.3014E-06                              | -3.555E-08                                         | 1.3383E-03              | 8.854E-05                             |
| 11.7             | 1026.6945                              | -0.1885                                              | 0.001333               | -3.658E-05                            | 1.2979E-06                              | -3.539E-08                                         | 1.3472E-03              | 8.906E-05                             |
| 11.8             | 1026.6756                              | -0.1890                                              | 0.001329               | -3.642E-05                            | 1.2943E-06                              | -3.523E-08                                         | 1.3561E-03              | 8.958E-05                             |
| 11.9             | 1026.6567                              | -0.1900                                              | 0.001325               | -3.625E-05                            | 1.2908E-06                              | -3.507E-08                                         | 1.3651E-03              | 9.010E-05                             |
| 12.0             | 1026.6376                              | -0.1915                                              | 0.001322               | -3.609E-05                            | 1.2873E-06                              | -3.492E-08                                         | 1.3741E-03              | 9.063E-05                             |
| 12.1             | 1026.6184                              | -0.1920                                              | 0.001318               | -3.593E-05                            | 1.2838E-06                              | -3.476E-08                                         | 1.3832E-03              | 9.115E-05                             |
| 12.2             | 1026.5992                              | -0.1930                                              | 0.001314               | -3.578E-05                            | 1.2804E-06                              | -3.461E-08                                         | 1.3924E-03              | 9.168E-05                             |
| 12.3             | 1026.5798                              | -0.1940                                              | 0.001311               | -3.562E-05                            | 1.2769E-06                              | -3.446E-08                                         | 1.4015E-03              | 9.221E-05                             |
| 12.4             | 1026.5604                              | -0.1950                                              | 0.001307               | -3.546E-05                            | 1.2735E-06                              | -3.430E-08                                         | 1.4108E-03              | 9.275E-05                             |
| 12.5             | 1026.5408                              | -0.1960                                              | 0.001304               | -3.531E-05                            | 1.2701E-06                              | -3.415E-08                                         | 1.4201E-03              | 9.329E-05                             |
| 12.6             | 1026.5212                              | -0.1970                                              | 0.001300               | -3.515E-05                            | 1.2666E-06                              | -3.400E-08                                         | 1.4295E-03              | 9.383E-05                             |
| 12.7             | 1026.5014                              | -0.1980                                              | 0.001297               | -3.500E-05                            | 1.2633E-06                              | -3.385E-08                                         | 1.4389E-03              | 9.437E-05                             |
| 12.8             | 1026.4816                              | -0.1985                                              | 0.001293               | -3.484E-05                            | 1.2599E-06                              | -3.370E-08                                         | 1.4483E-03              | 9.492E-05                             |
| 12.9             | 1026.4617                              | -0.2000                                              | 0.001290               | -3.469E-05                            | 1.2565E-06                              | -3.355E-08                                         | 1.4578E-03              | 9.546E-05                             |
| 13.0             | 1026.4416                              | -0.2010                                              | 0.001286               | -3.454E-05                            | 1.2532E-06                              | -3.341E-08                                         | 1.4674E-03              | 9.601E-05                             |
| 13.1             | 1026.4215                              | -0.2015                                              | 0.001283               | -3.439E-05                            | 1.2498E-06                              | -3.326E-08                                         | 1.4770E-03              | 9.657E-05                             |
| 13.2             | 1026.4013                              | -0.2030                                              | 0.001279               | -3.424E-05                            | 1.2465E-06                              | -3.312E-08                                         | 1.4867E-03              | 9.713E-05                             |
| 13.3             | 1026.3809                              | -0.2040                                              | 0.001276               | -3.409E-05                            | 1.2432E-06                              | -3.297E-08                                         | 1.4965E-03              | 9.768E-05                             |
| 13.4             | 1026.3605                              | -0.2045                                              | 0.001273               | -3.395E-05                            | 1.2399E-06                              | -3.283E-08                                         | 1.5063E-03              | 9.825E-05                             |
| 13.5             | 1026.3400                              | -0.2055                                              | 0.001269               | -3.380E-05                            | 1.2366E-06                              | -3.268E-08                                         | 1.5161E-03              | 9.881E-05                             |
| 13.6             | 1026.3194                              | -0.2065                                              | 0.001266               | -3.365E-05                            | 1.2334E-06                              | -3.254E-08                                         | 1.5260E-03              | 9.938E-05                             |
| 13.7             | 1026.2987                              | -0.2075                                              | 0.001262               | -3.351E-05                            | 1.2301E-06                              | -3.240E-08                                         | 1.5360E-03              | 9.995E-05                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 13.8             | 1026.2779                              | -0.2085                                              | 0.001259               | -3.337E-05                            | 1.2269E-06                              | -3.226E-08                                         | 1.5460E-03              | 1.005E-04                             |
| 13.9             | 1026.2570                              | -0.2095                                              | 0.001256               | -3.322E-05                            | 1.2237E-06                              | -3.212E-08                                         | 1.5561E-03              | 1.011E-04                             |
| 14.0             | 1026.2360                              | -0.2105                                              | 0.001252               | -3.308E-05                            | 1.2205E-06                              | -3.198E-08                                         | 1.5662E-03              | 1.017E-04                             |
| 14.1             | 1026.2149                              | -0.2110                                              | 0.001249               | -3.294E-05                            | 1.2173E-06                              | -3.185E-08                                         | 1.5764E-03              | 1.023E-04                             |
| 14.2             | 1026.1938                              | -0.2120                                              | 0.001246               | -3.280E-05                            | 1.2141E-06                              | -3.171E-08                                         | 1.5867E-03              | 1.028E-04                             |
| 14.3             | 1026.1725                              | -0.2135                                              | 0.001243               | -3.266E-05                            | 1.2109E-06                              | -3.157E-08                                         | 1.5970E-03              | 1.034E-04                             |
| 14.4             | 1026.1511                              | -0.2140                                              | 0.001239               | -3.252E-05                            | 1.2078E-06                              | -3.144E-08                                         | 1.6074E-03              | 1.040E-04                             |
| 14.5             | 1026.1297                              | -0.2150                                              | 0.001236               | -3.238E-05                            | 1.2047E-06                              | -3.130E-08                                         | 1.6178E-03              | 1.046E-04                             |
| 14.6             | 1026.1081                              | -0.2160                                              | 0.001233               | -3.224E-05                            | 1.2015E-06                              | -3.117E-08                                         | 1.6283E-03              | 1.052E-04                             |
| 14.7             | 1026.0865                              | -0.2170                                              | 0.001230               | -3.211E-05                            | 1.1984E-06                              | -3.104E-08                                         | 1.6389E-03              | 1.058E-04                             |
| 14.8             | 1026.0647                              | -0.2180                                              | 0.001226               | -3.197E-05                            | 1.1953E-06                              | -3.091E-08                                         | 1.6495E-03              | 1.064E-04                             |
| 14.9             | 1026.0429                              | -0.2185                                              | 0.001223               | -3.184E-05                            | 1.1922E-06                              | -3.077E-08                                         | 1.6601E-03              | 1.070E-04                             |
| 15.0             | 1026.0210                              | -0.2195                                              | 0.001220               | -3.170E-05                            | 1.1892E-06                              | -3.064E-08                                         | 1.6709E-03              | 1.076E-04                             |
| 15.1             | 1025.9990                              | -0.2205                                              | 0.001217               | -3.157E-05                            | 1.1861E-06                              | -3.051E-08                                         | 1.6817E-03              | 1.082E-04                             |
| 15.2             | 1025.9769                              | -0.2215                                              | 0.001214               | -3.144E-05                            | 1.1831E-06                              | -3.038E-08                                         | 1.6925E-03              | 1.088E-04                             |
| 15.3             | 1025.9547                              | -0.2225                                              | 0.001211               | -3.130E-05                            | 1.1800E-06                              | -3.026E-08                                         | 1.7034E-03              | 1.095E-04                             |
| 15.4             | 1025.9324                              | -0.2235                                              | 0.001208               | -3.117E-05                            | 1.1770E-06                              | -3.013E-08                                         | 1.7144E-03              | 1.101E-04                             |
| 15.5             | 1025.9100                              | -0.2245                                              | 0.001204               | -3.104E-05                            | 1.1740E-06                              | -3.000E-08                                         | 1.7254E-03              | 1.107E-04                             |
| 15.6             | 1025.8875                              | -0.2250                                              | 0.001201               | -3.091E-05                            | 1.1710E-06                              | -2.988E-08                                         | 1.7365E-03              | 1.113E-04                             |
| 15.7             | 1025.8650                              | -0.2260                                              | 0.001198               | -3.078E-05                            | 1.1680E-06                              | -2.975E-08                                         | 1.7477E-03              | 1.119E-04                             |
| 15.8             | 1025.8423                              | -0.2270                                              | 0.001195               | -3.066E-05                            | 1.1651E-06                              | -2.963E-08                                         | 1.7589E-03              | 1.126E-04                             |
| 15.9             | 1025.8196                              | -0.2280                                              | 0.001192               | -3.053E-05                            | 1.1621E-06                              | -2.950E-08                                         | 1.7702E-03              | 1.132E-04                             |
| 16.0             | 1025.7967                              | -0.2290                                              | 0.001189               | -3.040E-05                            | 1.1592E-06                              | -2.938E-08                                         | 1.7816E-03              | 1.139E-04                             |
| 16.1             | 1025.7738                              | -0.2295                                              | 0.001186               | -3.028E-05                            | 1.1562E-06                              | -2.926E-08                                         | 1.7930E-03              | 1.145E-04                             |
| 16.2             | 1025.7508                              | -0.2310                                              | 0.001183               | -3.015E-05                            | 1.1533E-06                              | -2.913E-08                                         | 1.8045E-03              | 1.151E-04                             |
| 16.3             | 1025.7276                              | -0.2320                                              | 0.001180               | -3.003E-05                            | 1.1504E-06                              | -2.901E-08                                         | 1.8160E-03              | 1.158E-04                             |
| 16.4             | 1025.7044                              | -0.2325                                              | 0.001177               | -2.990E-05                            | 1.1475E-06                              | -2.889E-08                                         | 1.8276E-03              | 1.164E-04                             |
| 16.5             | 1025.6811                              | -0.2330                                              | 0.001174               | -2.978E-05                            | 1.1446E-06                              | -2.877E-08                                         | 1.8393E-03              | 1.171E-04                             |
| 16.6             | 1025.6578                              | -0.2340                                              | 0.001171               | -2.966E-05                            | 1.1418E-06                              | -2.865E-08                                         | 1.8510E-03              | 1.177E-04                             |
| 16.7             | 1025.6343                              | -0.2355                                              | 0.001168               | -2.954E-05                            | 1.1389E-06                              | -2.854E-08                                         | 1.8629E-03              | 1.184E-04                             |
| 16.8             | 1025.6107                              | -0.2360                                              | 0.001165               | -2.942E-05                            | 1.1360E-06                              | -2.842E-08                                         | 1.8747E-03              | 1.191E-04                             |
| 16.9             | 1025.5871                              | -0.2370                                              | 0.001162               | -2.929E-05                            | 1.1332E-06                              | -2.830E-08                                         | 1.8867E-03              | 1.197E-04                             |
| 17.0             | 1025.5633                              | -0.2380                                              | 0.001159               | -2.918E-05                            | 1.1304E-06                              | -2.819E-08                                         | 1.8987E-03              | 1.204E-04                             |
| 17.1             | 1025.5395                              | -0.2385                                              | 0.001156               | -2.906E-05                            | 1.1276E-06                              | -2.807E-08                                         | 1.9107E-03              | 1.211E-04                             |
| 17.2             | 1025.5156                              | -0.2395                                              | 0.001153               | -2.894E-05                            | 1.1248E-06                              | -2.796E-08                                         | 1.9229E-03              | 1.217E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 17.3             | 1025.4916                              | -0.2405                                              | 0.001151               | -2.882E-05                            | 1.1220E-06                              | -2.784E-08                                         | 1.9351E-03              | 1.224E-04                             |
| 17.4             | 1025.4675                              | -0.2415                                              | 0.001148               | -2.870E-05                            | 1.1192E-06                              | -2.773E-08                                         | 1.9474E-03              | 1.231E-04                             |
| 17.5             | 1025.4433                              | -0.2425                                              | 0.001145               | -2.859E-05                            | 1.1164E-06                              | -2.761E-08                                         | 1.9597E-03              | 1.238E-04                             |
| 17.6             | 1025.4190                              | -0.2430                                              | 0.001142               | -2.847E-05                            | 1.1137E-06                              | -2.750E-08                                         | 1.9721E-03              | 1.245E-04                             |
| 17.7             | 1025.3947                              | -0.2440                                              | 0.001139               | -2.836E-05                            | 1.1109E-06                              | -2.739E-08                                         | 1.9846E-03              | 1.252E-04                             |
| 17.8             | 1025.3702                              | -0.2450                                              | 0.001136               | -2.824E-05                            | 1.1082E-06                              | -2.728E-08                                         | 1.9971E-03              | 1.258E-04                             |
| 17.9             | 1025.3457                              | -0.2460                                              | 0.001134               | -2.813E-05                            | 1.1055E-06                              | -2.717E-08                                         | 2.0098E-03              | 1.265E-04                             |
| 18.0             | 1025.3210                              | -0.2470                                              | 0.001131               | -2.801E-05                            | 1.1028E-06                              | -2.706E-08                                         | 2.0225E-03              | 1.272E-04                             |
| 18.1             | 1025.2963                              | -0.2475                                              | 0.001128               | -2.790E-05                            | 1.1001E-06                              | -2.695E-08                                         | 2.0352E-03              | 1.279E-04                             |
| 18.2             | 1025.2715                              | -0.2485                                              | 0.001125               | -2.779E-05                            | 1.0974E-06                              | -2.684E-08                                         | 2.0480E-03              | 1.287E-04                             |
| 18.3             | 1025.2466                              | -0.2495                                              | 0.001122               | -2.768E-05                            | 1.0947E-06                              | -2.673E-08                                         | 2.0609E-03              | 1.294E-04                             |
| 18.4             | 1025.2216                              | -0.2500                                              | 0.001120               | -2.757E-05                            | 1.0920E-06                              | -2.662E-08                                         | 2.0739E-03              | 1.301E-04                             |
| 18.5             | 1025.1966                              | -0.2510                                              | 0.001117               | -2.746E-05                            | 1.0894E-06                              | -2.652E-08                                         | 2.0870E-03              | 1.308E-04                             |
| 18.6             | 1025.1714                              | -0.2520                                              | 0.001114               | -2.735E-05                            | 1.0867E-06                              | -2.641E-08                                         | 2.1001E-03              | 1.315E-04                             |
| 18.7             | 1025.1462                              | -0.2525                                              | 0.001111               | -2.724E-05                            | 1.0841E-06                              | -2.631E-08                                         | 2.1133E-03              | 1.322E-04                             |
| 18.8             | 1025.1209                              | -0.2535                                              | 0.001109               | -2.713E-05                            | 1.0815E-06                              | -2.620E-08                                         | 2.1265E-03              | 1.330E-04                             |
| 18.9             | 1025.0955                              | -0.2545                                              | 0.001106               | -2.702E-05                            | 1.0789E-06                              | -2.610E-08                                         | 2.1399E-03              | 1.337E-04                             |
| 19.0             | 1025.0700                              | -0.2555                                              | 0.001103               | -2.692E-05                            | 1.0763E-06                              | -2.599E-08                                         | 2.1533E-03              | 1.344E-04                             |
| 19.1             | 1025.0444                              | -0.2565                                              | 0.001101               | -2.681E-05                            | 1.0737E-06                              | -2.589E-08                                         | 2.1667E-03              | 1.352E-04                             |
| 19.2             | 1025.0187                              | -0.2575                                              | 0.001098               | -2.671E-05                            | 1.0711E-06                              | -2.578E-08                                         | 2.1803E-03              | 1.359E-04                             |
| 19.3             | 1024.9929                              | -0.2580                                              | 0.001095               | -2.660E-05                            | 1.0685E-06                              | -2.568E-08                                         | 2.1939E-03              | 1.366E-04                             |
| 19.4             | 1024.9671                              | -0.2585                                              | 0.001093               | -2.650E-05                            | 1.0659E-06                              | -2.558E-08                                         | 2.2076E-03              | 1.374E-04                             |
| 19.5             | 1024.9412                              | -0.2595                                              | 0.001090               | -2.639E-05                            | 1.0634E-06                              | -2.548E-08                                         | 2.2214E-03              | 1.381E-04                             |
| 19.6             | 1024.9152                              | -0.2605                                              | 0.001087               | -2.629E-05                            | 1.0608E-06                              | -2.538E-08                                         | 2.2353E-03              | 1.389E-04                             |
| 19.7             | 1024.8891                              | -0.2615                                              | 0.001085               | -2.618E-05                            | 1.0583E-06                              | -2.528E-08                                         | 2.2492E-03              | 1.397E-04                             |
| 19.8             | 1024.8629                              | -0.2625                                              | 0.001082               | -2.608E-05                            | 1.0558E-06                              | -2.518E-08                                         | 2.2632E-03              | 1.404E-04                             |
| 19.9             | 1024.8366                              | -0.2630                                              | 0.001079               | -2.598E-05                            | 1.0533E-06                              | -2.508E-08                                         | 2.2773E-03              | 1.412E-04                             |
| 20.0             | 1024.8103                              | -0.2640                                              | 0.001077               | -2.588E-05                            | 1.0508E-06                              | -2.498E-08                                         | 2.2914E-03              | 1.419E-04                             |
| 20.1             | 1024.7838                              | -0.2650                                              | 0.001074               | -2.578E-05                            | 1.0483E-06                              | -2.488E-08                                         | 2.3056E-03              | 1.427E-04                             |
| 20.2             | 1024.7573                              | -0.2655                                              | 0.001072               | -2.568E-05                            | 1.0458E-06                              | -2.479E-08                                         | 2.3200E-03              | 1.435E-04                             |
| 20.3             | 1024.7307                              | -0.2665                                              | 0.001069               | -2.558E-05                            | 1.0433E-06                              | -2.469E-08                                         | 2.3343E-03              | 1.443E-04                             |
| 20.4             | 1024.7040                              | -0.2675                                              | 0.001067               | -2.548E-05                            | 1.0409E-06                              | -2.459E-08                                         | 2.3488E-03              | 1.451E-04                             |
| 20.5             | 1024.6772                              | -0.2680                                              | 0.001064               | -2.538E-05                            | 1.0384E-06                              | -2.450E-08                                         | 2.3634E-03              | 1.458E-04                             |
| 20.6             | 1024.6504                              | -0.2690                                              | 0.001061               | -2.528E-05                            | 1.0360E-06                              | -2.440E-08                                         | 2.3780E-03              | 1.466E-04                             |
| 20.7             | 1024.6234                              | -0.2700                                              | 0.001059               | -2.518E-05                            | 1.0335E-06                              | -2.431E-08                                         | 2.3927E-03              | 1.474E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 20.8             | 1024.5964                              | -0.2705                                              | 0.001056               | -2.509E-05                            | 1.0311E-06                              | -2.421E-08                                         | 2.4075E-03              | 1.482E-04                             |
| 20.9             | 1024.5693                              | -0.2715                                              | 0.001054               | -2.499E-05                            | 1.0287E-06                              | -2.412E-08                                         | 2.4223E-03              | 1.490E-04                             |
| 21.0             | 1024.5421                              | -0.2725                                              | 0.001051               | -2.489E-05                            | 1.0263E-06                              | -2.402E-08                                         | 2.4373E-03              | 1.498E-04                             |
| 21.1             | 1024.5148                              | -0.2735                                              | 0.001049               | -2.480E-05                            | 1.0239E-06                              | -2.393E-08                                         | 2.4523E-03              | 1.506E-04                             |
| 21.2             | 1024.4874                              | -0.2740                                              | 0.001047               | -2.470E-05                            | 1.0215E-06                              | -2.384E-08                                         | 2.4674E-03              | 1.514E-04                             |
| 21.3             | 1024.4600                              | -0.2745                                              | 0.001044               | -2.461E-05                            | 1.0191E-06                              | -2.375E-08                                         | 2.4826E-03              | 1.523E-04                             |
| 21.4             | 1024.4325                              | -0.2755                                              | 0.001042               | -2.451E-05                            | 1.0167E-06                              | -2.366E-08                                         | 2.4978E-03              | 1.531E-04                             |
| 21.5             | 1024.4049                              | -0.2765                                              | 0.001039               | -2.442E-05                            | 1.0144E-06                              | -2.357E-08                                         | 2.5132E-03              | 1.539E-04                             |
| 21.6             | 1024.3772                              | -0.2775                                              | 0.001037               | -2.433E-05                            | 1.0120E-06                              | -2.347E-08                                         | 2.5286E-03              | 1.547E-04                             |
| 21.7             | 1024.3494                              | -0.2785                                              | 0.001034               | -2.424E-05                            | 1.0097E-06                              | -2.338E-08                                         | 2.5441E-03              | 1.555E-04                             |
| 21.8             | 1024.3215                              | -0.2790                                              | 0.001032               | -2.414E-05                            | 1.0073E-06                              | -2.330E-08                                         | 2.5597E-03              | 1.564E-04                             |
| 21.9             | 1024.2936                              | -0.2795                                              | 0.001029               | -2.405E-05                            | 1.0050E-06                              | -2.321E-08                                         | 2.5754E-03              | 1.572E-04                             |
| 22.0             | 1024.2656                              | -0.2805                                              | 0.001027               | -2.396E-05                            | 1.0027E-06                              | -2.312E-08                                         | 2.5912E-03              | 1.581E-04                             |
| 22.1             | 1024.2375                              | -0.2815                                              | 0.001025               | -2.387E-05                            | 1.0004E-06                              | -2.303E-08                                         | 2.6070E-03              | 1.589E-04                             |
| 22.2             | 1024.2093                              | -0.2825                                              | 0.001022               | -2.378E-05                            | 9.9810E-07                              | -2.294E-08                                         | 2.6230E-03              | 1.598E-04                             |
| 22.3             | 1024.1810                              | -0.2835                                              | 0.001020               | -2.369E-05                            | 9.9581E-07                              | -2.285E-08                                         | 2.6390E-03              | 1.606E-04                             |
| 22.4             | 1024.1526                              | -0.2840                                              | 0.001018               | -2.360E-05                            | 9.9353E-07                              | -2.277E-08                                         | 2.6551E-03              | 1.615E-04                             |
| 22.5             | 1024.1242                              | -0.2845                                              | 0.001015               | -2.351E-05                            | 9.9126E-07                              | -2.268E-08                                         | 2.6713E-03              | 1.623E-04                             |
| 22.6             | 1024.0957                              | -0.2855                                              | 0.001013               | -2.342E-05                            | 9.8899E-07                              | -2.260E-08                                         | 2.6875E-03              | 1.632E-04                             |
| 22.7             | 1024.0671                              | -0.2865                                              | 0.001010               | -2.334E-05                            | 9.8674E-07                              | -2.251E-08                                         | 2.7039E-03              | 1.641E-04                             |
| 22.8             | 1024.0384                              | -0.2870                                              | 0.001008               | -2.325E-05                            | 9.8449E-07                              | -2.243E-08                                         | 2.7204E-03              | 1.649E-04                             |
| 22.9             | 1024.0097                              | -0.2880                                              | 0.001006               | -2.316E-05                            | 9.8225E-07                              | -2.234E-08                                         | 2.7369E-03              | 1.658E-04                             |
| 23.0             | 1023.9808                              | -0.2890                                              | 0.001004               | -2.307E-05                            | 9.8002E-07                              | -2.226E-08                                         | 2.7535E-03              | 1.667E-04                             |
| 23.1             | 1023.9519                              | -0.2895                                              | 0.001001               | -2.299E-05                            | 9.7780E-07                              | -2.217E-08                                         | 2.7702E-03              | 1.676E-04                             |
| 23.2             | 1023.9229                              | -0.2905                                              | 0.000999               | -2.290E-05                            | 9.7559E-07                              | -2.209E-08                                         | 2.7870E-03              | 1.684E-04                             |
| 23.3             | 1023.8938                              | -0.2910                                              | 0.000997               | -2.282E-05                            | 9.7338E-07                              | -2.201E-08                                         | 2.8039E-03              | 1.693E-04                             |
| 23.4             | 1023.8647                              | -0.2920                                              | 0.000994               | -2.273E-05                            | 9.7119E-07                              | -2.193E-08                                         | 2.8209E-03              | 1.702E-04                             |
| 23.5             | 1023.8354                              | -0.2930                                              | 0.000992               | -2.265E-05                            | 9.6900E-07                              | -2.184E-08                                         | 2.8380E-03              | 1.711E-04                             |
| 23.6             | 1023.8061                              | -0.2935                                              | 0.000990               | -2.256E-05                            | 9.6682E-07                              | -2.176E-08                                         | 2.8551E-03              | 1.720E-04                             |
| 23.7             | 1023.7767                              | -0.2945                                              | 0.000988               | -2.248E-05                            | 9.6464E-07                              | -2.168E-08                                         | 2.8724E-03              | 1.729E-04                             |
| 23.8             | 1023.7472                              | -0.2950                                              | 0.000985               | -2.240E-05                            | 9.6248E-07                              | -2.160E-08                                         | 2.8897E-03              | 1.739E-04                             |
| 23.9             | 1023.7177                              | -0.2955                                              | 0.000983               | -2.232E-05                            | 9.6032E-07                              | -2.152E-08                                         | 2.9071E-03              | 1.748E-04                             |
| 24.0             | 1023.6881                              | -0.2970                                              | 0.000981               | -2.223E-05                            | 9.5818E-07                              | -2.144E-08                                         | 2.9247E-03              | 1.757E-04                             |
| 24.1             | 1023.6583                              | -0.2980                                              | 0.000979               | -2.215E-05                            | 9.5604E-07                              | -2.136E-08                                         | 2.9423E-03              | 1.766E-04                             |
| 24.2             | 1023.6285                              | -0.2980                                              | 0.000976               | -2.207E-05                            | 9.5390E-07                              | -2.128E-08                                         | 2.9600E-03              | 1.775E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 24.3             | 1023.5987                              | -0.2990                                              | 0.000974               | -2.199E-05                            | 9.5178E-07                              | -2.120E-08                                         | 2.9778E-03              | 1.785E-04                             |
| 24.4             | 1023.5687                              | -0.3000                                              | 0.000972               | -2.191E-05                            | 9.4966E-07                              | -2.113E-08                                         | 2.9957E-03              | 1.794E-04                             |
| 24.5             | 1023.5387                              | -0.3005                                              | 0.000970               | -2.183E-05                            | 9.4755E-07                              | -2.105E-08                                         | 3.0137E-03              | 1.803E-04                             |
| 24.6             | 1023.5086                              | -0.3015                                              | 0.000968               | -2.175E-05                            | 9.4545E-07                              | -2.097E-08                                         | 3.0317E-03              | 1.813E-04                             |
| 24.7             | 1023.4784                              | -0.3025                                              | 0.000966               | -2.167E-05                            | 9.4336E-07                              | -2.089E-08                                         | 3.0499E-03              | 1.822E-04                             |
| 24.8             | 1023.4481                              | -0.3030                                              | 0.000963               | -2.159E-05                            | 9.4128E-07                              | -2.082E-08                                         | 3.0682E-03              | 1.832E-04                             |
| 24.9             | 1023.4178                              | -0.3040                                              | 0.000961               | -2.151E-05                            | 9.3920E-07                              | -2.074E-08                                         | 3.0866E-03              | 1.841E-04                             |
| 25.0             | 1023.3873                              | -0.3050                                              | 0.000959               | -2.143E-05                            | 9.3713E-07                              | -2.066E-08                                         | 3.1050E-03              | 1.851E-04                             |
| 25.1             | 1023.3568                              | -0.3050                                              | 0.000957               | -2.136E-05                            | 9.3506E-07                              | -2.059E-08                                         | 3.1236E-03              | 1.861E-04                             |
| 25.2             | 1023.3263                              | -0.3060                                              | 0.000955               | -2.128E-05                            | 9.3301E-07                              | -2.051E-08                                         | 3.1422E-03              | 1.870E-04                             |
| 25.3             | 1023.2956                              | -0.3070                                              | 0.000953               | -2.120E-05                            | 9.3096E-07                              | -2.044E-08                                         | 3.1610E-03              | 1.880E-04                             |
| 25.4             | 1023.2649                              | -0.3080                                              | 0.000951               | -2.112E-05                            | 9.2892E-07                              | -2.036E-08                                         | 3.1798E-03              | 1.890E-04                             |
| 25.5             | 1023.2340                              | -0.3085                                              | 0.000948               | -2.105E-05                            | 9.2689E-07                              | -2.029E-08                                         | 3.1988E-03              | 1.900E-04                             |
| 25.6             | 1023.2032                              | -0.3090                                              | 0.000946               | -2.097E-05                            | 9.2486E-07                              | -2.022E-08                                         | 3.2178E-03              | 1.910E-04                             |
| 25.7             | 1023.1722                              | -0.3105                                              | 0.000944               | -2.090E-05                            | 9.2284E-07                              | -2.014E-08                                         | 3.2370E-03              | 1.919E-04                             |
| 25.8             | 1023.1411                              | -0.3110                                              | 0.000942               | -2.082E-05                            | 9.2083E-07                              | -2.007E-08                                         | 3.2562E-03              | 1.929E-04                             |
| 25.9             | 1023.1100                              | -0.3115                                              | 0.000940               | -2.075E-05                            | 9.1883E-07                              | -2.000E-08                                         | 3.2756E-03              | 1.939E-04                             |
| 26.0             | 1023.0788                              | -0.3125                                              | 0.000938               | -2.067E-05                            | 9.1683E-07                              | -1.993E-08                                         | 3.2950E-03              | 1.949E-04                             |
| 26.1             | 1023.0475                              | -0.3130                                              | 0.000936               | -2.060E-05                            | 9.1485E-07                              | -1.985E-08                                         | 3.3146E-03              | 1.960E-04                             |
| 26.2             | 1023.0162                              | -0.3135                                              | 0.000934               | -2.053E-05                            | 9.1286E-07                              | -1.978E-08                                         | 3.3342E-03              | 1.970E-04                             |
| 26.3             | 1022.9848                              | -0.3145                                              | 0.000932               | -2.045E-05                            | 9.1089E-07                              | -1.971E-08                                         | 3.3539E-03              | 1.980E-04                             |
| 26.4             | 1022.9533                              | -0.3155                                              | 0.000930               | -2.038E-05                            | 9.0892E-07                              | -1.964E-08                                         | 3.3738E-03              | 1.990E-04                             |
| 26.5             | 1022.9217                              | -0.3165                                              | 0.000928               | -2.031E-05                            | 9.0696E-07                              | -1.957E-08                                         | 3.3937E-03              | 2.000E-04                             |
| 26.6             | 1022.8900                              | -0.3170                                              | 0.000926               | -2.023E-05                            | 9.0501E-07                              | -1.950E-08                                         | 3.4138E-03              | 2.011E-04                             |
| 26.7             | 1022.8583                              | -0.3175                                              | 0.000924               | -2.016E-05                            | 9.0306E-07                              | -1.943E-08                                         | 3.4340E-03              | 2.021E-04                             |
| 26.8             | 1022.8265                              | -0.3185                                              | 0.000922               | -2.009E-05                            | 9.0112E-07                              | -1.936E-08                                         | 3.4542E-03              | 2.031E-04                             |
| 26.9             | 1022.7946                              | -0.3195                                              | 0.000920               | -2.002E-05                            | 8.9919E-07                              | -1.929E-08                                         | 3.4746E-03              | 2.042E-04                             |
| 27.0             | 1022.7626                              | -0.3200                                              | 0.000918               | -1.995E-05                            | 8.9726E-07                              | -1.922E-08                                         | 3.4950E-03              | 2.052E-04                             |
| 27.1             | 1022.7306                              | -0.3205                                              | 0.000916               | -1.988E-05                            | 8.9534E-07                              | -1.916E-08                                         | 3.5156E-03              | 2.063E-04                             |
| 27.2             | 1022.6985                              | -0.3215                                              | 0.000914               | -1.981E-05                            | 8.9343E-07                              | -1.909E-08                                         | 3.5363E-03              | 2.073E-04                             |
| 27.3             | 1022.6663                              | -0.3225                                              | 0.000912               | -1.974E-05                            | 8.9152E-07                              | -1.902E-08                                         | 3.5571E-03              | 2.084E-04                             |
| 27.4             | 1022.6340                              | -0.3230                                              | 0.000910               | -1.967E-05                            | 8.8963E-07                              | -1.895E-08                                         | 3.5780E-03              | 2.095E-04                             |
| 27.5             | 1022.6017                              | -0.3235                                              | 0.000908               | -1.960E-05                            | 8.8773E-07                              | -1.889E-08                                         | 3.5990E-03              | 2.105E-04                             |
| 27.6             | 1022.5693                              | -0.3245                                              | 0.000906               | -1.953E-05                            | 8.8585E-07                              | -1.882E-08                                         | 3.6201E-03              | 2.116E-04                             |
| 27.7             | 1022.5368                              | -0.3255                                              | 0.000904               | -1.946E-05                            | 8.8397E-07                              | -1.875E-08                                         | 3.6413E-03              | 2.127E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 27.8             | 1022.5042                              | -0.3260                                              | 0.000902               | -1.939E-05                            | 8.8210E-07                              | -1.869E-08                                         | 3.6626E-03              | 2.138E-04                             |
| 27.9             | 1022.4716                              | -0.3265                                              | 0.000900               | -1.933E-05                            | 8.8023E-07                              | -1.862E-08                                         | 3.6840E-03              | 2.148E-04                             |
| 28.0             | 1022.4389                              | -0.3275                                              | 0.000898               | -1.926E-05                            | 8.7837E-07                              | -1.856E-08                                         | 3.7056E-03              | 2.159E-04                             |
| 28.1             | 1022.4061                              | -0.3280                                              | 0.000896               | -1.919E-05                            | 8.7652E-07                              | -1.849E-08                                         | 3.7272E-03              | 2.170E-04                             |
| 28.2             | 1022.3733                              | -0.3290                                              | 0.000894               | -1.913E-05                            | 8.7468E-07                              | -1.843E-08                                         | 3.7490E-03              | 2.181E-04                             |
| 28.3             | 1022.3403                              | -0.3300                                              | 0.000892               | -1.906E-05                            | 8.7284E-07                              | -1.836E-08                                         | 3.7709E-03              | 2.192E-04                             |
| 28.4             | 1022.3073                              | -0.3300                                              | 0.000890               | -1.899E-05                            | 8.7100E-07                              | -1.830E-08                                         | 3.7928E-03              | 2.204E-04                             |
| 28.5             | 1022.2743                              | -0.3310                                              | 0.000889               | -1.893E-05                            | 8.6918E-07                              | -1.823E-08                                         | 3.8149E-03              | 2.215E-04                             |
| 28.6             | 1022.2411                              | -0.3320                                              | 0.000887               | -1.886E-05                            | 8.6736E-07                              | -1.817E-08                                         | 3.8371E-03              | 2.226E-04                             |
| 28.7             | 1022.2079                              | -0.3325                                              | 0.000885               | -1.880E-05                            | 8.6554E-07                              | -1.811E-08                                         | 3.8595E-03              | 2.237E-04                             |
| 28.8             | 1022.1746                              | -0.3335                                              | 0.000883               | -1.873E-05                            | 8.6374E-07                              | -1.804E-08                                         | 3.8819E-03              | 2.249E-04                             |
| 28.9             | 1022.1412                              | -0.3340                                              | 0.000881               | -1.867E-05                            | 8.6193E-07                              | -1.798E-08                                         | 3.9044E-03              | 2.260E-04                             |
| 29.0             | 1022.1078                              | -0.3345                                              | 0.000879               | -1.860E-05                            | 8.6014E-07                              | -1.792E-08                                         | 3.9271E-03              | 2.271E-04                             |
| 29.1             | 1022.0743                              | -0.3355                                              | 0.000877               | -1.854E-05                            | 8.5835E-07                              | -1.786E-08                                         | 3.9499E-03              | 2.283E-04                             |
| 29.2             | 1022.0407                              | -0.3365                                              | 0.000875               | -1.847E-05                            | 8.5657E-07                              | -1.779E-08                                         | 3.9727E-03              | 2.294E-04                             |
| 29.3             | 1022.0070                              | -0.3370                                              | 0.000874               | -1.841E-05                            | 8.5479E-07                              | -1.773E-08                                         | 3.9957E-03              | 2.306E-04                             |
| 29.4             | 1021.9733                              | -0.3375                                              | 0.000872               | -1.835E-05                            | 8.5302E-07                              | -1.767E-08                                         | 4.0189E-03              | 2.317E-04                             |
| 29.5             | 1021.9395                              | -0.3385                                              | 0.000870               | -1.829E-05                            | 8.5126E-07                              | -1.761E-08                                         | 4.0421E-03              | 2.329E-04                             |
| 29.6             | 1021.9056                              | -0.3395                                              | 0.000868               | -1.822E-05                            | 8.4950E-07                              | -1.755E-08                                         | 4.0654E-03              | 2.341E-04                             |
| 29.7             | 1021.8716                              | -0.3400                                              | 0.000866               | -1.816E-05                            | 8.4775E-07                              | -1.749E-08                                         | 4.0889E-03              | 2.352E-04                             |
| 29.8             | 1021.8376                              | -0.3405                                              | 0.000864               | -1.810E-05                            | 8.4600E-07                              | -1.743E-08                                         | 4.1125E-03              | 2.364E-04                             |
| 29.9             | 1021.8035                              | -0.3410                                              | 0.000863               | -1.804E-05                            | 8.4426E-07                              | -1.737E-08                                         | 4.1362E-03              | 2.376E-04                             |
| 30.0             | 1021.7694                              | -0.3420                                              | 0.000861               | -1.798E-05                            | 8.4253E-07                              | -1.731E-08                                         | 4.1600E-03              | 2.388E-04                             |
| 30.1             | 1021.7351                              | -0.3430                                              | 0.000859               | -1.792E-05                            | 8.4080E-07                              | -1.725E-08                                         | 4.1839E-03              | 2.400E-04                             |
| 30.2             | 1021.7008                              | -0.3435                                              | 0.000857               | -1.785E-05                            | 8.3908E-07                              | -1.719E-08                                         | 4.2080E-03              | 2.412E-04                             |
| 30.3             | 1021.6664                              | -0.3440                                              | 0.000856               | -1.779E-05                            | 8.3736E-07                              | -1.713E-08                                         | 4.2322E-03              | 2.424E-04                             |
| 30.4             | 1021.6320                              | -0.3445                                              | 0.000854               | -1.773E-05                            | 8.3565E-07                              | -1.708E-08                                         | 4.2565E-03              | 2.436E-04                             |
| 30.5             | 1021.5975                              | -0.3455                                              | 0.000852               | -1.767E-05                            | 8.3395E-07                              | -1.702E-08                                         | 4.2809E-03              | 2.448E-04                             |
| 30.6             | 1021.5629                              | -0.3465                                              | 0.000850               | -1.761E-05                            | 8.3225E-07                              | -1.696E-08                                         | 4.3054E-03              | 2.460E-04                             |
| 30.7             | 1021.5282                              | -0.3470                                              | 0.000848               | -1.755E-05                            | 8.3055E-07                              | -1.690E-08                                         | 4.3301E-03              | 2.473E-04                             |
| 30.8             | 1021.4935                              | -0.3475                                              | 0.000847               | -1.750E-05                            | 8.2887E-07                              | -1.685E-08                                         | 4.3549E-03              | 2.485E-04                             |
| 30.9             | 1021.4587                              | -0.3485                                              | 0.000845               | -1.744E-05                            | 8.2718E-07                              | -1.679E-08                                         | 4.3798E-03              | 2.497E-04                             |
| 31.0             | 1021.4238                              | -0.3490                                              | 0.000843               | -1.738E-05                            | 8.2551E-07                              | -1.673E-08                                         | 4.4048E-03              | 2.510E-04                             |
| 31.1             | 1021.3889                              | -0.3500                                              | 0.000841               | -1.732E-05                            | 8.2384E-07                              | -1.668E-08                                         | 4.4300E-03              | 2.522E-04                             |
| 31.2             | 1021.3538                              | -0.3505                                              | 0.000840               | -1.726E-05                            | 8.2217E-07                              | -1.662E-08                                         | 4.4553E-03              | 2.535E-04                             |



| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 31.3             | 1021.3188                              | -0.3510                                              | 0.000838               | -1.720E-05                            | 8.2051E-07                              | -1.656E-08                                         | 4.4807E-03              | 2.547E-04                             |
| 31.4             | 1021.2836                              | -0.3520                                              | 0.000836               | -1.715E-05                            | 8.1886E-07                              | -1.651E-08                                         | 4.5062E-03              | 2.560E-04                             |
| 31.5             | 1021.2484                              | -0.3525                                              | 0.000835               | -1.709E-05                            | 8.1721E-07                              | -1.645E-08                                         | 4.5319E-03              | 2.572E-04                             |
| 31.6             | 1021.2131                              | -0.3535                                              | 0.000833               | -1.703E-05                            | 8.1557E-07                              | -1.640E-08                                         | 4.5577E-03              | 2.585E-04                             |
| 31.7             | 1021.1777                              | -0.3540                                              | 0.000831               | -1.698E-05                            | 8.1393E-07                              | -1.634E-08                                         | 4.5836E-03              | 2.598E-04                             |
| 31.8             | 1021.1423                              | -0.3545                                              | 0.000829               | -1.692E-05                            | 8.1230E-07                              | -1.629E-08                                         | 4.6096E-03              | 2.611E-04                             |
| 31.9             | 1021.1068                              | -0.3555                                              | 0.000828               | -1.686E-05                            | 8.1068E-07                              | -1.623E-08                                         | 4.6358E-03              | 2.624E-04                             |
| 32.0             | 1021.0712                              | -0.3560                                              | 0.000826               | -1.681E-05                            | 8.0906E-07                              | -1.618E-08                                         | 4.6621E-03              | 2.636E-04                             |
| 32.1             | 1021.0356                              | -0.3565                                              | 0.000824               | -1.675E-05                            | 8.0744E-07                              | -1.612E-08                                         | 4.6885E-03              | 2.649E-04                             |
| 32.2             | 1020.9999                              | -0.3575                                              | 0.000823               | -1.670E-05                            | 8.0583E-07                              | -1.607E-08                                         | 4.7151E-03              | 2.662E-04                             |
| 32.3             | 1020.9641                              | -0.3580                                              | 0.000821               | -1.664E-05                            | 8.0423E-07                              | -1.602E-08                                         | 4.7418E-03              | 2.676E-04                             |
| 32.4             | 1020.9283                              | -0.3585                                              | 0.000819               | -1.659E-05                            | 8.0263E-07                              | -1.596E-08                                         | 4.7686E-03              | 2.689E-04                             |
| 32.5             | 1020.8924                              | -0.3595                                              | 0.000818               | -1.653E-05                            | 8.0103E-07                              | -1.591E-08                                         | 4.7956E-03              | 2.702E-04                             |
| 32.6             | 1020.8564                              | -0.3605                                              | 0.000816               | -1.648E-05                            | 7.9944E-07                              | -1.586E-08                                         | 4.8227E-03              | 2.715E-04                             |
| 32.7             | 1020.8203                              | -0.3610                                              | 0.000814               | -1.642E-05                            | 7.9786E-07                              | -1.581E-08                                         | 4.8499E-03              | 2.728E-04                             |
| 32.8             | 1020.7842                              | -0.3615                                              | 0.000813               | -1.637E-05                            | 7.9628E-07                              | -1.575E-08                                         | 4.8772E-03              | 2.742E-04                             |
| 32.9             | 1020.7480                              | -0.3620                                              | 0.000811               | -1.632E-05                            | 7.9471E-07                              | -1.570E-08                                         | 4.9047E-03              | 2.755E-04                             |
| 33.0             | 1020.7118                              | -0.3625                                              | 0.000810               | -1.626E-05                            | 7.9314E-07                              | -1.565E-08                                         | 4.9323E-03              | 2.769E-04                             |
| 33.1             | 1020.6755                              | -0.3635                                              | 0.000808               | -1.621E-05                            | 7.9158E-07                              | -1.560E-08                                         | 4.9601E-03              | 2.782E-04                             |
| 33.2             | 1020.6391                              | -0.3645                                              | 0.000806               | -1.616E-05                            | 7.9002E-07                              | -1.555E-08                                         | 4.9880E-03              | 2.796E-04                             |
| 33.3             | 1020.6026                              | -0.3650                                              | 0.000805               | -1.610E-05                            | 7.8847E-07                              | -1.550E-08                                         | 5.0160E-03              | 2.809E-04                             |
| 33.4             | 1020.5661                              | -0.3655                                              | 0.000803               | -1.605E-05                            | 7.8692E-07                              | -1.545E-08                                         | 5.0442E-03              | 2.823E-04                             |
| 33.5             | 1020.5295                              | -0.3660                                              | 0.000802               | -1.600E-05                            | 7.8538E-07                              | -1.539E-08                                         | 5.0725E-03              | 2.837E-04                             |
| 33.6             | 1020.4929                              | -0.3670                                              | 0.000800               | -1.595E-05                            | 7.8385E-07                              | -1.534E-08                                         | 5.1009E-03              | 2.851E-04                             |
| 33.7             | 1020.4561                              | -0.3680                                              | 0.000798               | -1.589E-05                            | 7.8231E-07                              | -1.529E-08                                         | 5.1295E-03              | 2.864E-04                             |
| 33.8             | 1020.4193                              | -0.3680                                              | 0.000797               | -1.584E-05                            | 7.8079E-07                              | -1.524E-08                                         | 5.1582E-03              | 2.878E-04                             |
| 33.9             | 1020.3825                              | -0.3685                                              | 0.000795               | -1.579E-05                            | 7.7926E-07                              | -1.519E-08                                         | 5.1870E-03              | 2.892E-04                             |
| 34.0             | 1020.3456                              | -0.3695                                              | 0.000794               | -1.574E-05                            | 7.7775E-07                              | -1.515E-08                                         | 5.2160E-03              | 2.906E-04                             |
| 34.1             | 1020.3086                              | -0.3705                                              | 0.000792               | -1.569E-05                            | 7.7624E-07                              | -1.510E-08                                         | 5.2452E-03              | 2.920E-04                             |
| 34.2             | 1020.2715                              | -0.3710                                              | 0.000790               | -1.564E-05                            | 7.7473E-07                              | -1.505E-08                                         | 5.2744E-03              | 2.934E-04                             |
| 34.3             | 1020.2344                              | -0.3715                                              | 0.000789               | -1.559E-05                            | 7.7323E-07                              | -1.500E-08                                         | 5.3038E-03              | 2.949E-04                             |
| 34.4             | 1020.1972                              | -0.3720                                              | 0.000787               | -1.554E-05                            | 7.7173E-07                              | -1.495E-08                                         | 5.3334E-03              | 2.963E-04                             |
| 34.5             | 1020.1600                              | -0.3725                                              | 0.000786               | -1.549E-05                            | 7.7024E-07                              | -1.490E-08                                         | 5.3631E-03              | 2.977E-04                             |
| 34.6             | 1020.1227                              | -0.3735                                              | 0.000784               | -1.544E-05                            | 7.6875E-07                              | -1.485E-08                                         | 5.3929E-03              | 2.991E-04                             |
| 34.7             | 1020.0853                              | -0.3745                                              | 0.000783               | -1.539E-05                            | 7.6727E-07                              | -1.480E-08                                         | 5.4229E-03              | 3.006E-04                             |



**Fresh Water and Seawater Properties**

Effective Date  
2011

Revision  
02

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 34.8             | 1020.0478                              | -0.3750                                              | 0.000781               | -1.534E-05                            | 7.6579E-07                              | -1.476E-08                                         | 5.4531E-03              | 3.020E-04                             |
| 34.9             | 1020.0103                              | -0.3755                                              | 0.000780               | -1.529E-05                            | 7.6431E-07                              | -1.471E-08                                         | 5.4833E-03              | 3.035E-04                             |
| 35.0             | 1019.9727                              | -0.3760                                              | 0.000778               | -1.524E-05                            | 7.6285E-07                              | -1.466E-08                                         | 5.5138E-03              | 3.049E-04                             |
| 35.1             | 1019.9351                              | -0.3765                                              | 0.000777               | -1.519E-05                            | 7.6138E-07                              | -1.461E-08                                         | 5.5443E-03              | 3.064E-04                             |
| 35.2             | 1019.8974                              | -0.3775                                              | 0.000775               | -1.514E-05                            | 7.5992E-07                              | -1.457E-08                                         | 5.5750E-03              | 3.079E-04                             |
| 35.3             | 1019.8596                              | -0.3780                                              | 0.000774               | -1.510E-05                            | 7.5847E-07                              | -1.452E-08                                         | 5.6059E-03              | 3.094E-04                             |
| 35.4             | 1019.8218                              | -0.3785                                              | 0.000772               | -1.505E-05                            | 7.5702E-07                              | -1.447E-08                                         | 5.6369E-03              | 3.108E-04                             |
| 35.5             | 1019.7839                              | -0.3795                                              | 0.000771               | -1.500E-05                            | 7.5557E-07                              | -1.443E-08                                         | 5.6681E-03              | 3.123E-04                             |
| 35.6             | 1019.7459                              | -0.3800                                              | 0.000769               | -1.495E-05                            | 7.5413E-07                              | -1.438E-08                                         | 5.6994E-03              | 3.138E-04                             |
| 35.7             | 1019.7079                              | -0.3805                                              | 0.000768               | -1.491E-05                            | 7.5270E-07                              | -1.434E-08                                         | 5.7308E-03              | 3.153E-04                             |
| 35.8             | 1019.6698                              | -0.3810                                              | 0.000766               | -1.486E-05                            | 7.5127E-07                              | -1.429E-08                                         | 5.7624E-03              | 3.168E-04                             |
| 35.9             | 1019.6317                              | -0.3820                                              | 0.000765               | -1.481E-05                            | 7.4984E-07                              | -1.425E-08                                         | 5.7942E-03              | 3.183E-04                             |
| 36.0             | 1019.5934                              | -0.3825                                              | 0.000763               | -1.476E-05                            | 7.4842E-07                              | -1.420E-08                                         | 5.8261E-03              | 3.199E-04                             |
| 36.1             | 1019.5552                              | -0.3830                                              | 0.000762               | -1.472E-05                            | 7.4700E-07                              | -1.416E-08                                         | 5.8582E-03              | 3.214E-04                             |
| 36.2             | 1019.5168                              | -0.3840                                              | 0.000760               | -1.467E-05                            | 7.4559E-07                              | -1.411E-08                                         | 5.8904E-03              | 3.229E-04                             |
| 36.3             | 1019.4784                              | -0.3845                                              | 0.000759               | -1.463E-05                            | 7.4418E-07                              | -1.407E-08                                         | 5.9227E-03              | 3.244E-04                             |
| 36.4             | 1019.4399                              | -0.3850                                              | 0.000757               | -1.458E-05                            | 7.4277E-07                              | -1.402E-08                                         | 5.9553E-03              | 3.260E-04                             |
| 36.5             | 1019.4014                              | -0.3855                                              | 0.000756               | -1.453E-05                            | 7.4137E-07                              | -1.398E-08                                         | 5.9879E-03              | 3.275E-04                             |
| 36.6             | 1019.3628                              | -0.3865                                              | 0.000754               | -1.449E-05                            | 7.3998E-07                              | -1.393E-08                                         | 6.0208E-03              | 3.291E-04                             |
| 36.7             | 1019.3241                              | -0.3870                                              | 0.000753               | -1.444E-05                            | 7.3859E-07                              | -1.389E-08                                         | 6.0538E-03              | 3.306E-04                             |
| 36.8             | 1019.2854                              | -0.3875                                              | 0.000751               | -1.440E-05                            | 7.3720E-07                              | -1.384E-08                                         | 6.0869E-03              | 3.322E-04                             |
| 36.9             | 1019.2466                              | -0.3880                                              | 0.000750               | -1.435E-05                            | 7.3582E-07                              | -1.380E-08                                         | 6.1202E-03              | 3.338E-04                             |
| 37.0             | 1019.2078                              | -0.3885                                              | 0.000749               | -1.431E-05                            | 7.3444E-07                              | -1.376E-08                                         | 6.1537E-03              | 3.354E-04                             |
| 37.1             | 1019.1689                              | -0.3895                                              | 0.000747               | -1.426E-05                            | 7.3307E-07                              | -1.371E-08                                         | 6.1873E-03              | 3.369E-04                             |
| 37.2             | 1019.1299                              | -0.3900                                              | 0.000746               | -1.422E-05                            | 7.3170E-07                              | -1.367E-08                                         | 6.2210E-03              | 3.385E-04                             |
| 37.3             | 1019.0909                              | -0.3905                                              | 0.000744               | -1.417E-05                            | 7.3033E-07                              | -1.363E-08                                         | 6.2550E-03              | 3.401E-04                             |
| 37.4             | 1019.0518                              | -0.3915                                              | 0.000743               | -1.413E-05                            | 7.2897E-07                              | -1.359E-08                                         | 6.2891E-03              | 3.417E-04                             |
| 37.5             | 1019.0126                              | -0.3920                                              | 0.000741               | -1.409E-05                            | 7.2761E-07                              | -1.354E-08                                         | 6.3233E-03              | 3.433E-04                             |
| 37.6             | 1018.9734                              | -0.3925                                              | 0.000740               | -1.404E-05                            | 7.2626E-07                              | -1.350E-08                                         | 6.3577E-03              | 3.450E-04                             |
| 37.7             | 1018.9341                              | -0.3930                                              | 0.000739               | -1.400E-05                            | 7.2491E-07                              | -1.346E-08                                         | 6.3923E-03              | 3.466E-04                             |
| 37.8             | 1018.8948                              | -0.3935                                              | 0.000737               | -1.396E-05                            | 7.2357E-07                              | -1.342E-08                                         | 6.4270E-03              | 3.482E-04                             |
| 37.9             | 1018.8554                              | -0.3945                                              | 0.000736               | -1.391E-05                            | 7.2223E-07                              | -1.338E-08                                         | 6.4620E-03              | 3.498E-04                             |
| 38.0             | 1018.8159                              | -0.3950                                              | 0.000734               | -1.387E-05                            | 7.2089E-07                              | -1.333E-08                                         | 6.4970E-03              | 3.515E-04                             |
| 38.1             | 1018.7764                              | -0.3955                                              | 0.000733               | -1.383E-05                            | 7.1956E-07                              | -1.329E-08                                         | 6.5322E-03              | 3.531E-04                             |
| 38.2             | 1018.7368                              | -0.3960                                              | 0.000732               | -1.378E-05                            | 7.1824E-07                              | -1.325E-08                                         | 6.5676E-03              | 3.548E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 38.3             | 1018.6972                              | -0.3965                                              | 0.000730               | -1.374E-05                            | 7.1691E-07                              | -1.321E-08                                         | 6.6032E-03              | 3.564E-04                             |
| 38.4             | 1018.6575                              | -0.3975                                              | 0.000729               | -1.370E-05                            | 7.1559E-07                              | -1.317E-08                                         | 6.6389E-03              | 3.581E-04                             |
| 38.5             | 1018.6177                              | -0.3980                                              | 0.000728               | -1.366E-05                            | 7.1428E-07                              | -1.313E-08                                         | 6.6748E-03              | 3.598E-04                             |
| 38.6             | 1018.5779                              | -0.3985                                              | 0.000726               | -1.362E-05                            | 7.1297E-07                              | -1.309E-08                                         | 6.7109E-03              | 3.615E-04                             |
| 38.7             | 1018.5380                              | -0.3990                                              | 0.000725               | -1.357E-05                            | 7.1166E-07                              | -1.305E-08                                         | 6.7471E-03              | 3.631E-04                             |
| 38.8             | 1018.4981                              | -0.3995                                              | 0.000723               | -1.353E-05                            | 7.1036E-07                              | -1.301E-08                                         | 6.7835E-03              | 3.648E-04                             |
| 38.9             | 1018.4581                              | -0.4005                                              | 0.000722               | -1.349E-05                            | 7.0906E-07                              | -1.297E-08                                         | 6.8201E-03              | 3.665E-04                             |
| 39.0             | 1018.4180                              | -0.4010                                              | 0.000721               | -1.345E-05                            | 7.0776E-07                              | -1.293E-08                                         | 6.8568E-03              | 3.682E-04                             |
| 39.1             | 1018.3779                              | -0.4015                                              | 0.000719               | -1.341E-05                            | 7.0647E-07                              | -1.289E-08                                         | 6.8937E-03              | 3.700E-04                             |
| 39.2             | 1018.3377                              | -0.4020                                              | 0.000718               | -1.337E-05                            | 7.0519E-07                              | -1.285E-08                                         | 6.9308E-03              | 3.717E-04                             |
| 39.3             | 1018.2975                              | -0.4025                                              | 0.000717               | -1.333E-05                            | 7.0390E-07                              | -1.281E-08                                         | 6.9681E-03              | 3.734E-04                             |
| 39.4             | 1018.2572                              | -0.4035                                              | 0.000715               | -1.329E-05                            | 7.0262E-07                              | -1.277E-08                                         | 7.0055E-03              | 3.751E-04                             |
| 39.5             | 1018.2168                              | -0.4040                                              | 0.000714               | -1.325E-05                            | 7.0135E-07                              | -1.273E-08                                         | 7.0431E-03              | 3.769E-04                             |
| 39.6             | 1018.1764                              | -0.4040                                              | 0.000713               | -1.321E-05                            | 7.0008E-07                              | -1.269E-08                                         | 7.0809E-03              | 3.786E-04                             |
| 39.7             | 1018.1360                              | -0.4050                                              | 0.000711               | -1.317E-05                            | 6.9881E-07                              | -1.265E-08                                         | 7.1188E-03              | 3.804E-04                             |
| 39.8             | 1018.0954                              | -0.4060                                              | 0.000710               | -1.313E-05                            | 6.9755E-07                              | -1.262E-08                                         | 7.1569E-03              | 3.821E-04                             |
| 39.9             | 1018.0548                              | -0.4060                                              | 0.000709               | -1.309E-05                            | 6.9629E-07                              | -1.258E-08                                         | 7.1952E-03              | 3.839E-04                             |
| 40.0             | 1018.0142                              | -0.4065                                              | 0.000708               | -1.305E-05                            | 6.9503E-07                              | -1.254E-08                                         | 7.2337E-03              | 3.857E-04                             |
| 40.1             | 1017.9735                              | -0.4075                                              | 0.000706               | -1.301E-05                            | 6.9378E-07                              | -1.250E-08                                         | 7.2724E-03              | 3.874E-04                             |
| 40.2             | 1017.9327                              | -0.4080                                              | 0.000705               | -1.297E-05                            | 6.9253E-07                              | -1.246E-08                                         | 7.3112E-03              | 3.892E-04                             |
| 40.3             | 1017.8919                              | -0.4085                                              | 0.000704               | -1.293E-05                            | 6.9129E-07                              | -1.243E-08                                         | 7.3502E-03              | 3.910E-04                             |
| 40.4             | 1017.8510                              | -0.4090                                              | 0.000702               | -1.289E-05                            | 6.9005E-07                              | -1.239E-08                                         | 7.3894E-03              | 3.928E-04                             |
| 40.5             | 1017.8101                              | -0.4095                                              | 0.000701               | -1.285E-05                            | 6.8881E-07                              | -1.235E-08                                         | 7.4288E-03              | 3.946E-04                             |
| 40.6             | 1017.7691                              | -0.4100                                              | 0.000700               | -1.281E-05                            | 6.8758E-07                              | -1.231E-08                                         | 7.4683E-03              | 3.964E-04                             |
| 40.7             | 1017.7281                              | -0.4105                                              | 0.000699               | -1.278E-05                            | 6.8635E-07                              | -1.228E-08                                         | 7.5081E-03              | 3.983E-04                             |
| 40.8             | 1017.6870                              | -0.4115                                              | 0.000697               | -1.274E-05                            | 6.8512E-07                              | -1.224E-08                                         | 7.5480E-03              | 4.001E-04                             |
| 40.9             | 1017.6458                              | -0.4120                                              | 0.000696               | -1.270E-05                            | 6.8390E-07                              | -1.220E-08                                         | 7.5881E-03              | 4.019E-04                             |
| 41.0             | 1017.6046                              | -0.4125                                              | 0.000695               | -1.266E-05                            | 6.8268E-07                              | -1.217E-08                                         | 7.6284E-03              | 4.038E-04                             |
| 41.1             | 1017.5633                              | -0.4130                                              | 0.000693               | -1.262E-05                            | 6.8147E-07                              | -1.213E-08                                         | 7.6688E-03              | 4.056E-04                             |
| 41.2             | 1017.5220                              | -0.4135                                              | 0.000692               | -1.259E-05                            | 6.8026E-07                              | -1.209E-08                                         | 7.7095E-03              | 4.075E-04                             |
| 41.3             | 1017.4806                              | -0.4140                                              | 0.000691               | -1.255E-05                            | 6.7905E-07                              | -1.206E-08                                         | 7.7503E-03              | 4.093E-04                             |
| 41.4             | 1017.4392                              | -0.4145                                              | 0.000690               | -1.251E-05                            | 6.7784E-07                              | -1.202E-08                                         | 7.7914E-03              | 4.112E-04                             |
| 41.5             | 1017.3977                              | -0.4155                                              | 0.000688               | -1.247E-05                            | 6.7664E-07                              | -1.198E-08                                         | 7.8326E-03              | 4.131E-04                             |
| 41.6             | 1017.3561                              | -0.4160                                              | 0.000687               | -1.244E-05                            | 6.7545E-07                              | -1.195E-08                                         | 7.8740E-03              | 4.149E-04                             |
| 41.7             | 1017.3145                              | -0.4160                                              | 0.000686               | -1.240E-05                            | 6.7425E-07                              | -1.191E-08                                         | 7.9156E-03              | 4.168E-04                             |



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02

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 41.8             | 1017.2729                              | -0.4170                                              | 0.000685               | -1.236E-05                            | 6.7306E-07                              | -1.188E-08                                         | 7.9573E-03              | 4.187E-04                             |
| 41.9             | 1017.2311                              | -0.4175                                              | 0.000683               | -1.233E-05                            | 6.7188E-07                              | -1.184E-08                                         | 7.9993E-03              | 4.206E-04                             |
| 42.0             | 1017.1894                              | -0.4180                                              | 0.000682               | -1.229E-05                            | 6.7070E-07                              | -1.181E-08                                         | 8.0415E-03              | 4.225E-04                             |
| 42.1             | 1017.1475                              | -0.4185                                              | 0.000681               | -1.225E-05                            | 6.6952E-07                              | -1.177E-08                                         | 8.0838E-03              | 4.245E-04                             |
| 42.2             | 1017.1057                              | -0.4190                                              | 0.000680               | -1.222E-05                            | 6.6834E-07                              | -1.174E-08                                         | 8.1264E-03              | 4.264E-04                             |
| 42.3             | 1017.0637                              | -0.4200                                              | 0.000679               | -1.218E-05                            | 6.6717E-07                              | -1.170E-08                                         | 8.1691E-03              | 4.283E-04                             |
| 42.4             | 1017.0217                              | -0.4200                                              | 0.000677               | -1.215E-05                            | 6.6600E-07                              | -1.167E-08                                         | 8.2120E-03              | 4.303E-04                             |
| 42.5             | 1016.9797                              | -0.4205                                              | 0.000676               | -1.211E-05                            | 6.6484E-07                              | -1.163E-08                                         | 8.2551E-03              | 4.322E-04                             |
| 42.6             | 1016.9376                              | -0.4215                                              | 0.000675               | -1.208E-05                            | 6.6367E-07                              | -1.160E-08                                         | 8.2985E-03              | 4.342E-04                             |
| 42.7             | 1016.8954                              | -0.4220                                              | 0.000674               | -1.204E-05                            | 6.6252E-07                              | -1.156E-08                                         | 8.3420E-03              | 4.361E-04                             |
| 42.8             | 1016.8532                              | -0.4220                                              | 0.000673               | -1.200E-05                            | 6.6136E-07                              | -1.153E-08                                         | 8.3857E-03              | 4.381E-04                             |
| 42.9             | 1016.8110                              | -0.4225                                              | 0.000671               | -1.197E-05                            | 6.6021E-07                              | -1.150E-08                                         | 8.4296E-03              | 4.401E-04                             |
| 43.0             | 1016.7687                              | -0.4235                                              | 0.000670               | -1.193E-05                            | 6.5906E-07                              | -1.146E-08                                         | 8.4737E-03              | 4.420E-04                             |
| 43.1             | 1016.7263                              | -0.4240                                              | 0.000669               | -1.190E-05                            | 6.5792E-07                              | -1.143E-08                                         | 8.5180E-03              | 4.440E-04                             |
| 43.2             | 1016.6839                              | -0.4245                                              | 0.000668               | -1.187E-05                            | 6.5678E-07                              | -1.140E-08                                         | 8.5625E-03              | 4.460E-04                             |
| 43.3             | 1016.6414                              | -0.4250                                              | 0.000667               | -1.183E-05                            | 6.5564E-07                              | -1.136E-08                                         | 8.6072E-03              | 4.480E-04                             |
| 43.4             | 1016.5989                              | -0.4255                                              | 0.000665               | -1.180E-05                            | 6.5450E-07                              | -1.133E-08                                         | 8.6521E-03              | 4.501E-04                             |
| 43.5             | 1016.5563                              | -0.4260                                              | 0.000664               | -1.176E-05                            | 6.5337E-07                              | -1.130E-08                                         | 8.6972E-03              | 4.521E-04                             |
| 43.6             | 1016.5137                              | -0.4265                                              | 0.000663               | -1.173E-05                            | 6.5224E-07                              | -1.126E-08                                         | 8.7425E-03              | 4.541E-04                             |
| 43.7             | 1016.4710                              | -0.4270                                              | 0.000662               | -1.169E-05                            | 6.5112E-07                              | -1.123E-08                                         | 8.7880E-03              | 4.561E-04                             |
| 43.8             | 1016.4283                              | -0.4275                                              | 0.000661               | -1.166E-05                            | 6.5000E-07                              | -1.120E-08                                         | 8.8338E-03              | 4.582E-04                             |
| 43.9             | 1016.3855                              | -0.4280                                              | 0.000660               | -1.163E-05                            | 6.4888E-07                              | -1.117E-08                                         | 8.8797E-03              | 4.602E-04                             |
| 44.0             | 1016.3427                              | -0.4285                                              | 0.000658               | -1.159E-05                            | 6.4776E-07                              | -1.113E-08                                         | 8.9258E-03              | 4.623E-04                             |
| 44.1             | 1016.2998                              | -0.4295                                              | 0.000657               | -1.156E-05                            | 6.4665E-07                              | -1.110E-08                                         | 8.9721E-03              | 4.644E-04                             |
| 44.2             | 1016.2568                              | -0.4300                                              | 0.000656               | -1.153E-05                            | 6.4554E-07                              | -1.107E-08                                         | 9.0187E-03              | 4.664E-04                             |
| 44.3             | 1016.2138                              | -0.4300                                              | 0.000655               | -1.149E-05                            | 6.4444E-07                              | -1.104E-08                                         | 9.0654E-03              | 4.685E-04                             |
| 44.4             | 1016.1708                              | -0.4305                                              | 0.000654               | -1.146E-05                            | 6.4334E-07                              | -1.100E-08                                         | 9.1124E-03              | 4.706E-04                             |
| 44.5             | 1016.1277                              | -0.4310                                              | 0.000653               | -1.143E-05                            | 6.4224E-07                              | -1.097E-08                                         | 9.1595E-03              | 4.727E-04                             |
| 44.6             | 1016.0846                              | -0.4315                                              | 0.000651               | -1.139E-05                            | 6.4114E-07                              | -1.094E-08                                         | 9.2069E-03              | 4.748E-04                             |
| 44.7             | 1016.0414                              | -0.4325                                              | 0.000650               | -1.136E-05                            | 6.4005E-07                              | -1.091E-08                                         | 9.2545E-03              | 4.769E-04                             |
| 44.8             | 1015.9981                              | -0.4330                                              | 0.000649               | -1.133E-05                            | 6.3896E-07                              | -1.088E-08                                         | 9.3023E-03              | 4.790E-04                             |
| 44.9             | 1015.9548                              | -0.4330                                              | 0.000648               | -1.130E-05                            | 6.3787E-07                              | -1.085E-08                                         | 9.3503E-03              | 4.812E-04                             |
| 45.0             | 1015.9115                              | -0.4335                                              | 0.000647               | -1.126E-05                            | 6.3679E-07                              | -1.082E-08                                         | 9.3985E-03              | 4.833E-04                             |
| 45.1             | 1015.8681                              | -0.4345                                              | 0.000646               | -1.123E-05                            | 6.3571E-07                              | -1.078E-08                                         | 9.4470E-03              | 4.854E-04                             |
| 45.2             | 1015.8246                              | -0.4350                                              | 0.000645               | -1.120E-05                            | 6.3463E-07                              | -1.075E-08                                         | 9.4956E-03              | 4.876E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 45.3             | 1015.7811                              | -0.4350                                              | 0.000644               | -1.117E-05                            | 6.3356E-07                              | -1.072E-08                                         | 9.5445E-03              | 4.897E-04                             |
| 45.4             | 1015.7376                              | -0.4355                                              | 0.000642               | -1.114E-05                            | 6.3249E-07                              | -1.069E-08                                         | 9.5936E-03              | 4.919E-04                             |
| 45.5             | 1015.6940                              | -0.4360                                              | 0.000641               | -1.110E-05                            | 6.3142E-07                              | -1.066E-08                                         | 9.6429E-03              | 4.941E-04                             |
| 45.6             | 1015.6504                              | -0.4365                                              | 0.000640               | -1.107E-05                            | 6.3036E-07                              | -1.063E-08                                         | 9.6924E-03              | 4.963E-04                             |
| 45.7             | 1015.6067                              | -0.4375                                              | 0.000639               | -1.104E-05                            | 6.2930E-07                              | -1.060E-08                                         | 9.7421E-03              | 4.984E-04                             |
| 45.8             | 1015.5629                              | -0.4380                                              | 0.000638               | -1.101E-05                            | 6.2824E-07                              | -1.057E-08                                         | 9.7921E-03              | 5.006E-04                             |
| 45.9             | 1015.5191                              | -0.4380                                              | 0.000637               | -1.098E-05                            | 6.2718E-07                              | -1.054E-08                                         | 9.8422E-03              | 5.028E-04                             |
| 46.0             | 1015.4753                              | -0.4385                                              | 0.000636               | -1.095E-05                            | 6.2613E-07                              | -1.051E-08                                         | 9.8926E-03              | 5.051E-04                             |
| 46.1             | 1015.4314                              | -0.4390                                              | 0.000635               | -1.092E-05                            | 6.2508E-07                              | -1.048E-08                                         | 9.9433E-03              | 5.073E-04                             |
| 46.2             | 1015.3875                              | -0.4395                                              | 0.000634               | -1.089E-05                            | 6.2403E-07                              | -1.045E-08                                         | 9.9941E-03              | 5.095E-04                             |
| 46.3             | 1015.3435                              | -0.4400                                              | 0.000633               | -1.085E-05                            | 6.2299E-07                              | -1.042E-08                                         | 1.0045E-02              | 5.118E-04                             |
| 46.4             | 1015.2995                              | -0.4405                                              | 0.000631               | -1.082E-05                            | 6.2195E-07                              | -1.039E-08                                         | 1.0096E-02              | 5.140E-04                             |
| 46.5             | 1015.2554                              | -0.4415                                              | 0.000630               | -1.079E-05                            | 6.2091E-07                              | -1.036E-08                                         | 1.0148E-02              | 5.163E-04                             |
| 46.6             | 1015.2112                              | -0.4415                                              | 0.000629               | -1.076E-05                            | 6.1988E-07                              | -1.033E-08                                         | 1.0200E-02              | 5.185E-04                             |
| 46.7             | 1015.1671                              | -0.4415                                              | 0.000628               | -1.073E-05                            | 6.1885E-07                              | -1.030E-08                                         | 1.0252E-02              | 5.208E-04                             |
| 46.8             | 1015.1229                              | -0.4425                                              | 0.000627               | -1.070E-05                            | 6.1782E-07                              | -1.027E-08                                         | 1.0304E-02              | 5.231E-04                             |
| 46.9             | 1015.0786                              | -0.4430                                              | 0.000626               | -1.067E-05                            | 6.1679E-07                              | -1.025E-08                                         | 1.0356E-02              | 5.253E-04                             |
| 47.0             | 1015.0343                              | -0.4435                                              | 0.000625               | -1.064E-05                            | 6.1577E-07                              | -1.022E-08                                         | 1.0409E-02              | 5.276E-04                             |
| 47.1             | 1014.9899                              | -0.4440                                              | 0.000624               | -1.061E-05                            | 6.1475E-07                              | -1.019E-08                                         | 1.0462E-02              | 5.299E-04                             |
| 47.2             | 1014.9455                              | -0.4445                                              | 0.000623               | -1.058E-05                            | 6.1373E-07                              | -1.016E-08                                         | 1.0515E-02              | 5.323E-04                             |
| 47.3             | 1014.9010                              | -0.4450                                              | 0.000622               | -1.055E-05                            | 6.1272E-07                              | -1.013E-08                                         | 1.0568E-02              | 5.346E-04                             |
| 47.4             | 1014.8565                              | -0.4450                                              | 0.000621               | -1.052E-05                            | 6.1170E-07                              | -1.010E-08                                         | 1.0622E-02              | 5.369E-04                             |
| 47.5             | 1014.8120                              | -0.4455                                              | 0.000620               | -1.050E-05                            | 6.1069E-07                              | -1.007E-08                                         | 1.0676E-02              | 5.392E-04                             |
| 47.6             | 1014.7674                              | -0.4460                                              | 0.000619               | -1.047E-05                            | 6.0969E-07                              | -1.005E-08                                         | 1.0730E-02              | 5.416E-04                             |
| 47.7             | 1014.7228                              | -0.4465                                              | 0.000618               | -1.044E-05                            | 6.0869E-07                              | -1.002E-08                                         | 1.0784E-02              | 5.439E-04                             |
| 47.8             | 1014.6781                              | -0.4470                                              | 0.000617               | -1.041E-05                            | 6.0769E-07                              | -9.990E-09                                         | 1.0838E-02              | 5.463E-04                             |
| 47.9             | 1014.6334                              | -0.4475                                              | 0.000616               | -1.038E-05                            | 6.0669E-07                              | -9.962E-09                                         | 1.0893E-02              | 5.487E-04                             |
| 48.0             | 1014.5886                              | -0.4480                                              | 0.000615               | -1.035E-05                            | 6.0569E-07                              | -9.934E-09                                         | 1.0948E-02              | 5.510E-04                             |
| 48.1             | 1014.5438                              | -0.4485                                              | 0.000613               | -1.032E-05                            | 6.0470E-07                              | -9.906E-09                                         | 1.1003E-02              | 5.534E-04                             |
| 48.2             | 1014.4989                              | -0.4490                                              | 0.000612               | -1.029E-05                            | 6.0371E-07                              | -9.879E-09                                         | 1.1059E-02              | 5.558E-04                             |
| 48.3             | 1014.4540                              | -0.4495                                              | 0.000611               | -1.026E-05                            | 6.0273E-07                              | -9.851E-09                                         | 1.1115E-02              | 5.582E-04                             |
| 48.4             | 1014.4090                              | -0.4500                                              | 0.000610               | -1.024E-05                            | 6.0174E-07                              | -9.824E-09                                         | 1.1171E-02              | 5.606E-04                             |
| 48.5             | 1014.3640                              | -0.4500                                              | 0.000609               | -1.021E-05                            | 6.0076E-07                              | -9.797E-09                                         | 1.1227E-02              | 5.630E-04                             |
| 48.6             | 1014.3190                              | -0.4505                                              | 0.000608               | -1.018E-05                            | 5.9978E-07                              | -9.770E-09                                         | 1.1283E-02              | 5.655E-04                             |
| 48.7             | 1014.2739                              | -0.4510                                              | 0.000607               | -1.015E-05                            | 5.9881E-07                              | -9.743E-09                                         | 1.1340E-02              | 5.679E-04                             |

| Temp $t$<br>(°C) | Density $\rho$<br>(kg/m <sup>3</sup> ) | $\partial\rho/\partial t$<br>(kg/m <sup>3</sup> ·°C) | Viscos $\mu$<br>(Pa·s) | $\partial\mu/\partial t$<br>(Pa·s/°C) | $\nu = \mu/\rho$<br>(m <sup>2</sup> /s) | $\partial\nu/\partial t$<br>(m <sup>2</sup> /s·°C) | Pressure $p_v$<br>(MPa) | $\partial p_v/\partial t$<br>(MPa/°C) |
|------------------|----------------------------------------|------------------------------------------------------|------------------------|---------------------------------------|-----------------------------------------|----------------------------------------------------|-------------------------|---------------------------------------|
| 48.8             | 1014.2288                              | -0.4515                                              | 0.000606               | -1.012E-05                            | 5.9783E-07                              | -9.716E-09                                         | 1.1397E-02              | 5.704E-04                             |
| 48.9             | 1014.1836                              | -0.4520                                              | 0.000605               | -1.010E-05                            | 5.9686E-07                              | -9.689E-09                                         | 1.1454E-02              | 5.728E-04                             |
| 49.0             | 1014.1384                              | -0.4525                                              | 0.000604               | -1.007E-05                            | 5.9590E-07                              | -9.662E-09                                         | 1.1511E-02              | 5.753E-04                             |
| 49.1             | 1014.0931                              | -0.4530                                              | 0.000603               | -1.004E-05                            | 5.9493E-07                              | -9.635E-09                                         | 1.1569E-02              | 5.777E-04                             |
| 49.2             | 1014.0478                              | -0.4530                                              | 0.000602               | -1.001E-05                            | 5.9397E-07                              | -9.609E-09                                         | 1.1627E-02              | 5.802E-04                             |
| 49.3             | 1014.0025                              | -0.4535                                              | 0.000601               | -9.986E-06                            | 5.9301E-07                              | -9.583E-09                                         | 1.1685E-02              | 5.827E-04                             |
| 49.4             | 1013.9571                              | -0.4540                                              | 0.000600               | -9.959E-06                            | 5.9205E-07                              | -9.557E-09                                         | 1.1743E-02              | 5.852E-04                             |
| 49.5             | 1013.9117                              | -0.4545                                              | 0.000599               | -9.931E-06                            | 5.9110E-07                              | -9.530E-09                                         | 1.1802E-02              | 5.877E-04                             |
| 49.6             | 1013.8662                              | -0.4550                                              | 0.000598               | -9.904E-06                            | 5.9015E-07                              | -9.504E-09                                         | 1.1861E-02              | 5.902E-04                             |
| 49.7             | 1013.8207                              | -0.4555                                              | 0.000597               | -9.877E-06                            | 5.8920E-07                              | -9.478E-09                                         | 1.1920E-02              | 5.928E-04                             |
| 49.8             | 1013.7751                              | -0.4560                                              | 0.000596               | -9.850E-06                            | 5.8825E-07                              | -9.452E-09                                         | 1.1979E-02              | 5.953E-04                             |
| 49.9             | 1013.7295                              | -0.4560                                              | 0.000595               | -9.823E-06                            | 5.8731E-07                              | -9.426E-09                                         | 1.2039E-02              | 5.978E-04                             |
| 50.0             | 1013.6839                              |                                                      | 0.000594               |                                       | 5.8637E-07                              |                                                    | 1.2099E-02              |                                       |