The International Association for the Properties of Water and Steam

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Revised Release on the IAPS Formulation 1985 for the Viscosity of Ordinary Water Substance

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This release replaces the corresponding release of 1985 and contains 15 pages.

This release has been authorized by the International Association for the Properties of Water and Steam (IAPWS) at its meeting in Erlangen, Germany, 14-20 September 1997, for issue by its Secretariat. The members of IAPWS are: Argentina, Canada, the Czech Republic, Denmark, France, Germany, Italy, Japan, Russia, the United Kingdom, and the United States of America.

Further information about this release and other releases issued by IAPWS can be obtained from the Executive Secretary of IAPWS.

The material contained in this release is identical to that contained in the Release on the IAPS Formulation 1985 for the Viscosity of Ordinary Water Substance, issued by IAPS in September, 1984, except for some minor revisions to make the information consistent with the equations contained in the Release on the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use and the International Temperature Scale of 1990.

Contents of this Release

Appendix A contains a *Table of Critically-Evaluated Experimental Data*. The original experimental data have been collected in the document "International Input of the Dynamic Viscosity of Water Substance," K. Scheffler, N. Rosner, and M. Reimann (Institut A für Thermodynamik, Technische Universität, München, revised ed., 1974). The tables give values reduced to a uniform grid with the aid of the algorithm described in the paper "The Dynamic Viscosity of Water Substance," K. Scheffler, J. Straub, and U. Grigull, published in the Proceedings of the 7th Symposium on Thermophysical Properties, edited by A. Cezairliyan (American Society of Mechanical Engineers, New York, 1977), pp. 684-694.

The table in Appendix A also gives tolerances which constitute estimates of the reliability of the values given as assessed by IAPWS.

This material is unchanged from the Release on the IAPS Formulation 1985 for the Viscosity of Ordinary Water Substance.

Appendix B contains a *Recommended Interpolating Equation*. This equation reproduces the data given in Appendix A within the assigned tolerances. It is a slightly modified version of an interpolating equation issued by IAPS in September, 1975. A discussion of the equation can be found in Sections 3 and 4 of the paper "Representative Equations for the Viscosity of Water Substance," J. V. Sengers and B. Kamgar-Parsi, Journal of Physical and Chemical Reference Data **13** (1984), pp. 185-205.

This material has been revised to conform to the Release on the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use and the ITS-90 temperature scale.

Appendix C gives tables of viscosity values calculated at selected grid points from the recommended interpolating equation defined in Appendix B. These represent internally-consistent viscosity values and are included for practical convenience.

The viscosities in these tables have been recalculated to conform to the revised equations of Appendix B.

Appendix A: Table of Critically-Evaluated Experimental Data (reduced to a uniform grid)

This material is unchanged from the Release on the IAPS Formulation 1985 for the Viscosity of Ordinary Water Substance.

Upper value: viscosity of water or steam, μ in μPa·s .

Lower value: uncertainty in the viscosity, $\pm \Delta\mu$ in μPa·s .

Pressure P in MPa.

Temperature t in °C.

The point shown in italics represents an extrapolation into a region where the equilibrium phase is a solid.

Appendix A - Viscosity of Water and Steam

P/MPa	Temperature/°C						
	0	25	50	75	100	150	200
0.1	*1791*	890.9	547.1	377.3	12.42	14.29	16.26
	18	8.9	5.5	3.8	0.25	0.29	0.33
0.5	1790	891.2	546.7	378.0	281.7	182.3	16.05
	18	8.9	5.5	3.8	2.8	1.8	0.32
1	1789	891.1	546.8	378.2	281.9	182.4	15.92
	18	8.9	5.5	3.8	2.8	1.8	0.32
2.5	1786	890.8	547.1	378.5	282.3	182.8	134.6
	18	8.9	5.5	3.8	2.8	1.8	1.4
5	1780	890.3	547.7	379.2	283.1	183.4	135.2
	18	8.9	5.5	3.8	2.8	1.8	1.4
7.5	1774	889.8	548.3	379.8	283.8	184.1	135.9
	18	8.9	5.5	3.8	2.8	1.8	1.4
10	1768	889.4	548.7	380.4	284.7	184.7	136.4
	18	8.9	5.5	3.8	2.9	1.9	1.4
12.5	1762	889.1	549.1	381.0	285.3	185.3	137.0
	18	8.9	5.5	3.8	2.9	1.9	1.4
15	1756	888.7	549.5	381.6	286.0	186.0	137.6
	18	8.9	5.5	3.8	2.9	1.9	1.4
17.5	1750	888.5	550.0	382.3	286.7	186.6	138.2
	18	8.9	5.5	3.8	2.9	1.9	1.4
20	1744	888.2	550.4	382.9	287.4	187.3	138.8
	17	8.9	5.5	3.8	2.9	1.9	1.4
22.5	1738	887.9	550.9	383.5	288.0	187.9	139.4
	17	8.9	5.5	3.8	2.9	1.9	1.4
25	1733	887.6	551.3	384.2	288.7	188.5	140.0
	17	8.9	5.5	3.8	2.9	1.9	1.4
27.5	1728	887.4	551.8	384.8	289.4	189.1	140.6
	17	8.9	5.5	3.9	2.9	1.9	1.4
30	1723	887.2	552.3	385.5	290.0	189.8	141.2
	17	8.9	5.5	3.9	2.9	1.9	1.4
35	1713	886.8	553.3	386.7	291.4	191.0	142.3
	17	8.9	5.5	3.9	2.9	1.9	1.4
40	1705	886.6	554.3	388.0	292.7	192.2	143.5
	17	8.9	5.5	3.9	2.9	1.9	1.4
45	1697	886.5	555.3	389.3	294.0	193.4	144.6
	17	8.9	5.6	3.9	2.9	1.9	1.5
50	1690	886.4	556.3	390.6	295.4	194.6	145.8
	17	8.9	5.6	3.9	3.0	2.0	1.5
55	1684	886.5	557.4	392.0	296.7	195.8	146.9
	17	8.9	5.6	3.9	3.0	2.0	1.5
60	1679	886.7	558.5	393.3	298.0	197.0	148.0
	17	8.9	5.6	3.9	3.0	2.0	1.5
65	1674	886.9	559.7	394.6	299.4	198.2	149.0
	17	8.9	5.6	4.0	3.0	2.0	1.5
70	1670	887.3	560.9	395.9	300.7	199.4	150.1
	17	8.9	5.6	4.0	3.0	2.0	1.5
75	1666	887.7	562.0	397.3	302.0	200.6	151.2
	17	8.9	5.6	4.0	3.0	2.0	1.5
80	1662	888.3	563.3	398.6	303.4	201.8	152.3
	17	8.9	5.6	4.0	3.0	2.0	1.5
85	1659	888.8	564.5	400.0	304.6	203.0	153.3
	17	8.9	5.7	4.0	3.1	2.0	1.5
90	1656	889.5	565.8	401.4	305.9	204.2	154.3
	17	8.9	5.7	4.0	3.1	2.0	1.5
95	1653	890.3	567.1	402.8	307.3	205.4	155.4
	17	8.9	5.7	4.0	3.1	2.1	1.6
100	1651	891.1	568.4	404.2	308.6	206.5	156.4
	17	8.9	5.7	4.0	3.1	2.1	1.6

Appendix A (continued)

P/MPa	Temperature/°C						
	250	300	350	375	400	425	500
0.1	18.30	20.36	22.43	23.45	24.47	25.49	26.50
	0.37	0.41	0.45	0.47	0.49	0.51	0.53
0.5	18.16	20.25	22.32	23.43	24.44	25.49	26.53
	0.36	0.41	0.45	0.47	0.49	0.51	0.53
1	18.09	20.21	22.29	23.40	24.43	25.49	26.53
	0.36	0.40	0.45	0.47	0.49	0.51	0.53
2.5	17.85	20.07	22.22	23.37	24.41	25.49	26.54
	0.36	0.40	0.44	0.47	0.49	0.51	0.53
5	106.5	19.88	22.15	23.33	24.42	25.52	26.60
	1.1	0.40	0.44	0.47	0.49	0.51	0.53
7.5	107.2	19.75	22.12	23.34	24.46	25.58	26.68
	1.1	0.40	0.44	0.47	0.49	0.51	0.53
10	107.8	87.1	22.16	23.39	24.52	25.65	26.75
	1.1	1.7	0.44	0.47	0.49	0.51	0.53
12.5	108.5	88.0	22.35	23.57	24.69	25.81	26.91
	1.1	1.8	0.45	0.47	0.49	0.52	0.54
15	109.1	89.0	22.84	23.88	24.98	26.06	27.13
	1.1	1.8	0.46	0.48	0.50	0.52	0.54
17.5	109.8	89.9	67.3	24.49	25.37	26.38	27.42
	1.1	1.8	2.0	0.49	0.51	0.53	0.55
20	110.4	90.8	69.5	25.85	26.03	26.83	27.80
	1.1	1.8	2.1	0.52	0.52	0.54	0.56
22.5	111.1	91.6	71.4	48.2	27.11	27.50	28.31
	1.1	1.8	2.1	3.9	0.54	0.55	0.57
25	111.7	92.4	73.0	58.8	29.10	28.43	28.99
	1.1	1.9	2.2	1.2	0.58	0.57	0.58
27.5	112.3	93.1	74.4	62.4	33.88	29.81	29.84
	1.1	1.9	2.2	1.2	0.68	0.60	0.60
30	112.9	93.9	75.7	64.9	43.97	31.84	30.97
	1.1	1.9	2.3	1.3	0.88	0.64	0.62
35	114.1	95.3	78.0	68.6	56.4	39.47	34.19
	1.1	1.9	2.3	1.4	1.1	0.79	0.68
40	115.3	96.5	79.9	71.3	62.1	49.26	39.16
	1.2	1.9	2.4	1.4	1.2	0.99	0.78
45	116.4	97.8	81.7	73.7	65.8	55.6	44.87
	1.2	2.0	2.5	1.5	1.3	1.1	0.90
50	117.6	99.0	83.4	75.9	68.2	60.1	50.5
	1.2	2.0	2.5	2.3	2.0	1.8	1.5
55	118.7	100.2	84.9	77.8	70.9	63.6	55.3
	1.2	2.0	2.6	2.3	2.1	1.9	1.7
60	119.7	101.3	86.3	79.5	73.1	66.1	59.2
	1.2	2.0	2.6	2.4	2.2	2.0	1.8
65	120.8	102.5	87.7	81.1	75.2	68.1	62.3
	1.2	2.1	2.6	2.4	2.3	2.0	1.9
70	121.9	103.6	89.0	82.5	76.9	70.5	64.9
	1.2	2.1	2.7	2.5	2.3	2.1	2.0
75	122.9	104.6	90.3	83.9	78.5	72.2	66.9
	1.2	2.1	2.7	2.5	2.4	2.2	2.0
80	123.9	105.6	91.4	85.2	79.9	74.0	68.3
	1.2	2.1	2.7	2.6	2.4	2.2	2.1
85	124.9	106.6	92.6	86.4	81.4	75.8	70.2
	1.3	2.1	2.8	2.6	2.4	2.3	2.1
90	125.9	107.6	93.7	87.5	82.7	77.2	72.3
	1.3	2.2	2.8	2.6	2.5	2.3	2.2
95	126.9	108.6	94.7	88.7	83.6	78.6	73.8
	1.3	2.2	2.8	2.7	2.5	2.4	2.2
100	127.9	109.6	95.8	89.8	85.0	79.8	74.6
	1.3	2.2	2.9	2.7	2.6	2.4	2.2

Appendix A (continued)

P/MPa	Temperature/°C							
	475	500	550	600	650	700	750	800
0.1	27.51	28.52	30.53	32.55	34.6	36.6	38.6	40.5
	0.55	0.86	0.92	0.98	1.0	1.1	1.2	1.2
0.5	27.57	28.64	30.67	32.77	34.7	36.7	38.5	40.3
	0.55	0.86	0.92	0.98	1.0	1.1	1.2	1.2
1	27.58	28.65	30.68	32.79	34.8	36.8	38.5	40.4
	0.55	0.86	0.92	0.98	1.0	1.1	1.2	1.2
2.5	27.59	28.66	30.72	32.84	34.8	36.8	38.6	40.4
	0.55	0.86	0.92	0.99	1.0	1.1	1.2	1.2
5	27.66	28.73	30.82	32.77	34.9	36.9	38.7	40.6
	0.55	0.86	0.92	0.98	1.1	1.1	1.2	1.2
7.5	27.76	28.81	30.94	32.87	34.9	37.0	38.8	40.7
	0.56	0.86	0.93	0.99	1.1	1.1	1.2	1.2
10	27.82	28.95	31.08	33.02	35.1	37.2	39.0	40.9
	0.56	0.87	0.93	0.99	1.1	1.1	1.2	1.2
12.5	27.98	29.09	31.19	33.2	35.2	37.4	39.2	41.1
	0.56	0.87	0.94	1.0	1.1	1.1	1.2	1.2
15	28.18	29.30	31.44	33.4	35.5	37.6	39.4	41.2
	0.56	0.88	0.94	1.0	1.1	1.1	1.2	1.2
17.5	28.42	29.49	31.70	33.7	35.7	37.8	39.6	41.4
	0.57	0.88	0.95	1.0	1.1	1.1	1.2	1.2
20	28.76	29.81	31.98	33.9	35.9	38.0	39.8	41.6
	0.58	0.89	0.96	1.0	1.1	1.1	1.2	1.3
22.5	29.17	30.17	32.38	34.2	36.2	38.2	39.8	41.9
	0.58	0.91	0.97	1.0	1.1	1.2	1.2	1.3
25	29.70	30.56	32.73	34.6	36.5	38.5	40.2	41.9
	0.59	0.92	0.98	1.0	1.1	1.2	1.2	1.3
27.5	30.33	31.08	33.11	34.9	36.8	38.7	40.4	42.2
	0.61	0.93	0.99	1.1	1.1	1.2	1.2	1.3
30	31.06	31.68	33.6	35.3	37.2	39.0	40.7	42.5
	0.62	0.95	1.0	1.1	1.1	1.2	1.2	1.3
35	33.17	33.10	34.6	36.1	37.9	39.8	41.3	43.0
	0.66	0.99	1.0	1.1	1.1	1.2	1.2	1.3
40	36.06	35.2	35.7	37.5	38.8	40.4	42.0	43.7
	0.72	1.1	1.1	1.1	1.2	1.2	1.3	1.3
45	39.90	37.6	37.4	38.6	40.0	41.2	43.1	44.4
	0.80	1.1	1.1	1.2	1.2	1.2	1.3	1.3
50	44.0	40.5	39.1	40.0	40.6	42.2	43.7	45.3
	1.3	1.2	1.2	1.2	1.2	1.3	1.3	1.4
55	48.4	43.9	41.0	41.4	41.8	42.5	44.6	45.9
	1.5	1.3	1.2	1.2	1.3	1.3	1.3	1.4
60	52.3	47.6	43.1	41.7	42.9	43.2	44.8	46.6
	1.6	1.4	1.3	1.3	1.3	1.3	1.3	1.4
65	55.5	50.8	45.1	43.2	43.9	44.2	45.4	46.8
	1.7	1.5	1.4	1.3	1.3	1.3	1.4	1.4
70	58.8	53.7	47.5	44.8	44.3	44.4	46.2	47.4
	1.8	1.6	1.4	1.3	1.3	1.3	1.4	1.4
75	61.3	56.2	49.7	45.7	45.5	45.6	46.8	48.1
	1.8	1.7	1.5	1.4	1.4	1.4	1.4	1.4
80	63.6	58.7	52.1	47.4	47.0	46.6	47.3	48.6
	1.9	1.8	1.6	1.4	1.4	1.4	1.4	1.5
85	65.5	60.8	54.0	49.9	47.6	47.6	48.1	49.0
	2.0	1.8	1.6	1.5	1.4	1.4	1.4	1.5
90	67.3	62.8	55.8	51.4	48.9	49.1	48.9	49.7
	2.0	1.9	1.7	1.5	1.5	1.5	1.5	1.5
95	69.1	64.6	57.7	53.6	50.9	49.5	49.8	50.3
	2.1	1.9	1.7	1.6	1.5	1.5	1.5	1.5
100	69.8	66.1	59.3	55.1	52.1	50.5	51.1	51.0
	2.1	2.0	1.8	1.7	1.6	1.5	1.5	1.5

Appendix B: Recommended Interpolating Equation

This material has been revised to conform to the Release on the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use and the ITS-90 temperature scale.

B.1. Nomenclature

T denotes absolute temperature on the International Temperature Scale of 1990

ρ denotes density[1]

P denotes pressure

μ denotes viscosity

B.2. Reference constants

Reference temperature:	$T^* = 647.226$ K	(1)
reference density:	$\rho^* = 317.763$ kg/m^3	(2)
reference pressure:	$P^* = 22.115 \times 10^6$ Pa	(3)
reference viscosity:	$\mu^* = 55.071 \times 10^{-6}$ Pa·s	(4)

The three reference constants T^*, ρ^*, and P^* are close to, but not identical with, the critical point constants.

B.3. Dimensionless variables

Temperature:	$\bar{T} = T/T^*$	(5)
density:	$\bar{\rho} = \rho/\rho^*$	(6)
pressure	$\bar{P} = P/P^*$	(7)
viscosity:	$\bar{\mu} = \mu/\mu^*$	(8)

[1]To reproduce the values given in Appendix C, the density should be computed with the aid of theIAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use. If another density formulation is used, a relative departure of $\Delta\rho/\rho$ induces, at most, a relative departure $\pm\Delta\mu/\mu = 2.5\Delta\rho/\rho$ in viscosity.

B.4. Range of validity of equation

IAPWS endorses the validity of Eq. (10) for the viscosity in the following range of pressures P and temperatures t

$P \le 500$ MPa for $0\ ^\circ\text{C} \le t \le 150\ ^\circ\text{C}$,

$P \le 350$ MPa for $150\ ^\circ\text{C} < t \le 600\ ^\circ\text{C}$,

$P \le 300$ MPa for $600\ ^\circ\text{C} < t \le 900\ ^\circ\text{C}$. (9)

B.5 Interpolating equation

The viscosity is represented by the equation

$$\bar{\mu} = \bar{\mu}_0(\bar{T}) \times \bar{\mu}_1(\bar{T},\bar{\rho}) \times \bar{\mu}_2(\bar{T},\bar{\rho}). \tag{10}$$

The first term of the product gives the viscosity of steam in the ideal gas limit and has the form

$$\bar{\mu}_0(\bar{T}) = \frac{\sqrt{\bar{T}}}{\sum_{i=0}^{3} \frac{H_i}{\bar{T}^i}} \tag{11}$$

with the coefficients H_i given in Table B.I. The second multiplicative factor is

$$\bar{\mu}_1(\bar{T},\bar{\rho}) = \exp\left[\bar{\rho} \sum_{i=0}^{5} \sum_{j=0}^{6} H_{ij} \left(\frac{1}{\bar{T}} - 1\right)^i (\bar{\rho} - 1)^j\right] \tag{12}$$

with the coefficients H_{ij} given in Table B.II. For industrial use, the function $\bar{\mu}_2$ may be taken to be unity everywhere in the range specified by Eq. (9):

$$\bar{\mu}_2 = 1 \quad . \tag{13}$$

For general and scientific use, the function $\bar{\mu}_2$ is again given by Eq. (13) except for a very narrow near-critical range circumscribed by:

$$0.9970 \leq \bar{T} \leq 1.0082 \ , \quad 0.755 \leq \bar{\rho} \leq 1.290. \tag{14}$$

Inside the near-critical region defined by Eq. (14), it is first necessary to calculate

$$\bar{\chi}_T \equiv \bar{\rho} \left(\frac{\partial \bar{\rho}}{\partial \bar{P}} \right)_{\bar{T}} \tag{15}$$

and then to interpret $\bar{\mu}_2$ as

$$\begin{aligned} \bar{\mu}_2 &= 0.922 \ \bar{\chi}_T^{\,0.0263} \quad , \text{ if } \bar{\chi}_T \geq 21.93 \\ \bar{\mu}_2 &= 1 \qquad\qquad\qquad\quad , \text{ if } \bar{\chi}_T < 21.93 \end{aligned} \tag{16}$$

Table B.I. Coefficients H_i for $\bar{\mu}_0(\bar{T})$

H_0	=	1.000 000
H_1	=	0.978 197
H_2	=	0.579 829
H_3	=	-0.202 354

Table B.II. Coefficients H_{ij} for $\bar{\mu}_1(\bar{T}, \bar{\rho})$

i	j	H_{ij}
0	0	H_{00} = 0.513 204 7
1	0	H_{10} = 0.320 565 6
4	0	H_{40} = -0.778 256 7
5	0	H_{50} = 0.188 544 7
0	1	H_{01} = 0.215 177 8
1	1	H_{11} = 0.731 788 3
2	1	H_{21} = 1.241 044
3	1	H_{31} = 1.476 783
0	2	H_{02} = -0.281 810 7
1	2	H_{12} = -1.070 786
2	2	H_{22} = -1.263 184
0	3	H_{03} = 0.177 806 4
1	3	H_{13} = 0.460 504 0
2	3	H_{23} = 0.234 037 9
3	3	H_{33} = -0.492 417 9
0	4	H_{04} = -0.041 766 10
3	4	H_{34} = 0.160 043 5
1	5	H_{15} = -0.015 783 86
3	6	H_{36} = -0.003 629 481

Note: Coefficients H_{ij} omitted from the table are all equal to zero identically.

Appendix C: Viscosity Calculated for Water and Steam

The viscosities in these tables have been recalculated to conform to the revised equations of Appendix B.

Table C.I. Values of the Viscosity of Ordinary Water Substance Obtained with the Aid of the Recommended Interpolating Equation.

Viscosity μ in μPa·s .
Pressure P in MPa.
Temperature t in °C.

Table C.I. lists values for the viscosity calculated with the aid of the interpolating equation defined in Appendix B and with density values from the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use.

The point shown in italics represents an extrapolation into a region where the equilibrium phase is a solid.

Note: For the purpose of program verification, the tabular entries contain more digits than justified by the tolerances listed in the Table in Appendix A.

Table C.I. Values of the viscosity of ordinary water substance obtained with the aid of the recommended interpolating equation.[a] The viscosity, μ, is given in μPa·s.

P/MPa	Temperature/°C										
	0	25	50	75	100	150	200	250	300	350	375
0.1	*1792*	890.1	546.8	377.7	12.27	14.18	16.18	18.22	20.29	22.37	23.41
0.5	1791	890.0	546.9	377.8	281.8	182.5	16.05	18.14	20.24	22.34	23.39
1	1789	889.9	547.0	378.0	282.0	182.6	15.89	18.05	20.18	22.31	23.37
2.5	1786	889.5	547.3	378.4	282.4	183.0	134.6	17.76	20.02	22.23	23.31
5	1780	889.0	547.7	379.0	283.1	183.6	135.2	106.4	19.80	22.13	23.26
7.5	1774	888.5	548.2	379.7	283.7	184.2	135.8	107.1	19.66	22.09	23.26
10	1768	888.0	548.6	380.3	284.4	184.9	136.4	107.8	86.46	22.15	23.33
12.5	1762	887.6	549.1	381.0	285.1	185.5	137.0	108.4	87.42	22.37	23.51
15	1757	887.1	549.6	381.6	285.7	186.1	137.6	109.1	88.33	22.94	23.86
17.5	1752	886.8	550.1	382.3	286.4	186.7	138.2	109.8	89.21	66.99	24.51
20	1747	886.4	550.6	382.9	287.1	187.3	138.8	110.4	90.05	69.31	25.92
22.5	1742	886.1	551.1	383.6	287.7	187.9	139.4	111.0	90.86	71.17	47.79
25	1737	885.8	551.6	384.3	288.4	188.6	140.0	111.6	91.65	72.76	58.25
27.5	1732	885.5	552.1	384.9	289.1	189.2	140.6	112.2	92.41	74.18	61.97
30	1728	885.3	552.6	385.6	289.7	189.8	141.1	112.9	93.15	75.46	64.56
35	1719	884.9	553.7	386.9	291.1	191.0	142.3	114.0	94.58	77.74	68.36
40	1711	884.7	554.8	388.3	292.4	192.2	143.4	115.2	95.93	79.75	71.28
45	1704	884.5	556.0	389.7	293.7	193.4	144.5	116.3	97.23	81.56	73.71
50	1697	884.5	557.2	391.0	295.1	194.6	145.6	117.4	98.48	83.23	75.83
55	1690	884.6	558.4	392.4	296.4	195.7	146.7	118.5	99.69	84.78	77.73
60	1684	884.7	559.6	393.8	297.7	196.9	147.8	119.6	100.9	86.24	79.46
65	1679	885.0	560.9	395.2	299.1	198.1	148.8	120.6	102.0	87.62	81.06
70	1673	885.4	562.2	396.6	300.4	199.2	149.9	121.6	103.1	88.93	82.56
75	1669	885.9	563.5	398.0	301.7	200.4	150.9	122.7	104.1	90.17	83.97
80	1665	886.4	564.9	399.4	303.1	201.5	151.9	123.6	105.2	91.37	85.30
85	1661	887.1	566.3	400.8	304.4	202.6	153.0	124.6	106.2	92.52	86.57
90	1658	887.9	567.7	402.3	305.7	203.8	154.0	125.6	107.2	93.63	87.78
95	1655	888.7	569.1	403.7	307.0	204.9	155.0	126.5	108.2	94.70	88.94
100	1652	889.7	570.6	405.1	308.4	206.0	155.9	127.5	109.1	95.74	90.06

[a]Table C.I lists values for the viscosity calculated with the aid of the interpolating equation defined in Appendix B and with density values from the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use.

Table C.I. (continued). Values of the viscosity of ordinary water substance obtained with the aid of the recommended interpolating equation.

P/MPa	Temperature/°C										
	400	425	450	475	500	550	600	650	700	750	800
0.1	24.45	25.49	26.52	27.55	28.57	30.61	32.62	34.60	36.55	38.48	40.38
0.5	24.44	25.48	26.52	27.55	28.58	30.62	32.63	34.61	36.57	38.50	40.39
1	24.42	25.47	26.52	27.55	28.59	30.63	32.65	34.63	36.59	38.52	40.41
2.5	24.39	25.46	26.52	27.57	28.61	30.67	32.70	34.70	36.66	38.59	40.48
5	24.37	25.47	26.55	27.62	28.68	30.77	32.81	34.81	36.78	38.71	40.60
7.5	24.40	25.52	26.62	27.71	28.78	30.88	32.94	34.95	36.92	38.85	40.74
10	24.49	25.62	26.73	27.83	28.91	31.03	33.09	35.10	37.07	39.00	40.88
12.5	24.65	25.79	26.90	28.00	29.08	31.20	33.26	35.27	37.24	39.16	41.04
15	24.93	26.03	27.13	28.21	29.29	31.40	33.46	35.46	37.42	39.34	41.21
17.5	25.36	26.37	27.42	28.49	29.54	31.63	33.68	35.67	37.62	39.53	41.39
20	26.03	26.85	27.81	28.82	29.85	31.90	33.92	35.90	37.84	39.74	41.59
22.5	27.14	27.51	28.31	29.24	30.21	32.20	34.19	36.15	38.07	39.95	41.79
25	29.17	28.45	28.95	29.74	30.64	32.55	34.49	36.42	38.32	40.18	42.01
27.5	33.87	29.82	29.78	30.36	31.14	32.93	34.82	36.71	38.58	40.43	42.24
30	43.94	31.87	30.85	31.10	31.72	33.36	35.17	37.02	38.86	40.68	42.47
35	55.79	39.36	34.03	33.08	33.18	34.36	35.97	37.70	39.47	41.23	42.98
40	61.27	48.57	39.02	35.89	35.11	35.58	36.89	38.47	40.14	41.83	43.53
45	65.03	54.94	45.02	39.60	37.56	37.02	37.94	39.32	40.86	42.48	44.11
50	67.99	59.35	50.48	43.85	40.50	38.69	39.12	40.25	41.65	43.16	44.72
55	70.47	62.76	54.86	48.07	43.75	40.58	40.42	41.26	42.49	43.89	45.37
60	72.64	65.58	58.41	51.89	47.05	42.64	41.84	42.34	43.38	44.66	46.05
65	74.57	68.00	61.38	55.22	50.22	44.82	43.34	43.49	44.31	45.45	46.75
70	76.34	70.13	63.95	58.11	53.15	47.05	44.92	44.69	45.28	46.28	47.48
75	77.97	72.06	66.22	60.67	55.81	49.27	46.56	45.93	46.29	47.13	48.22
80	79.49	73.81	68.26	62.96	58.22	51.43	48.21	47.21	47.32	48.00	48.98
85	80.92	75.44	70.12	65.04	60.43	53.50	49.87	48.51	48.37	48.89	49.75
90	82.26	76.96	71.83	66.94	62.46	55.48	51.51	49.81	49.44	49.78	50.53
95	83.54	78.38	73.42	68.69	64.33	57.35	53.12	51.12	50.51	50.69	51.31
100	84.76	79.73	74.91	70.32	66.07	59.12	54.69	52.42	51.59	51.60	52.10

Table C.II. Values of the Viscosity of Ordinary Water Substance obtained with the Aid of the Recommended Interpolating Equation, Calculated along the Saturation Line.

Viscosity of saturated liquid, μ', and viscosity of saturated vapor, μ'', in μPa·s
Pressure P in MPa.
Temperature t in °C.

Table C.II lists values for the viscosity calculated with the aid of the interpolating equation defined in Appendix B with saturation pressures and saturation densities from the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use.

Table C.II. Values of the viscosity of ordinary water substance obtained with the aid of the recommended interpolating equation, calculated along the saturation line.[b] The viscosity of the saturated liquid, μ', and the viscosity of the saturated vapor, μ'', are given in μPa·s.

t	P	μ'	μ''
°C	MPa	μPa·s	μPa·s
0.01	0.000 611 7	1791	9.22
10	0.001 228	1306	9.46
20	0.002 339	1002	9.73
30	0.004 247	797.4	10.01
40	0.007 385	653.0	10.31
50	0.012 35	546.8	10.62
60	0.019 95	466.4	10.93
70	0.031 20	403.9	11.26
80	0.047 41	354.3	11.59
90	0.070 18	314.4	11.93
100	0.101 42	281.7	12.27
110	0.143 38	254.7	12.61
120	0.198 67	232.1	12.96
130	0.270 28	212.9	13.30
140	0.361 54	196.5	13.65
150	0.476 16	182.5	13.99
160	0.618 23	170.2	14.34
170	0.792 19	159.6	14.68
180	1.0028	150.1	15.03
190	1.2552	141.8	15.37
200	1.5549	134.3	15.71
210	1.9077	127.6	16.06
220	2.3196	121.5	16.41
230	2.7971	116.0	16.76
240	3.3469	110.9	17.12
250	3.9762	106.1	17.49
260	4.6923	101.7	17.88
270	5.5030	97.50	18.28
280	6.4166	93.51	18.70
290	7.4418	89.66	19.15
300	8.5879	85.90	19.65
310	9.8651	82.17	20.21
320	11.284	78.41	20.85
330	12.858	74.54	21.61
340	14.601	70.43	22.55
350	16.529	65.88	23.82
360	18.666	60.33	25.72
370	21.044	52.07	29.68
371	21.297	50.75	30.48
372	21.554	49.07	31.53
373	21.814	47.81	33.71

[b]Table C.II lists values for the viscosity calculated with the aid of the interpolating equation defined in Appendix B with saturation pressures and saturation densities from the IAPWS Formulation 1995 for the Thermodynamic Properties of Ordinary Water Substance for General and Scientific Use.