

Editorial Changes to "Advisory Note No. 5: Thermodynamic Properties of Seawater for Industrial Use"

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Motivation and objective of Advisory Note No. 5

- ▶ "Advisory Note No. 5: Thermodynamic Properties of Seawater for Industrial Use" (2013)

$$g(p, T, S) = g^w(p, T) + g^s(p, T, S)$$

Water part from IAPWS-IF97,

Region 1, calculated $g^w = g_1^{97}(p, T)$

Saline part from IAPWS 2008

Description of Corrections (Editorial Changes)

- ▶ Table A1 in the Appendix of AN5 contains three rounding errors in the test values for calculating properties of seawater for verification
- ▶ Konstantin Orlov discovered these errors now (at the time of adoption of AN5 he was a member of the evaluation committee)
- ▶ Errors confirmed by the authors of AN5 and corrected
- ▶ Smaller Corrections made in the Reference section

Corrections (Editorial Changes) in Table A1 of Advisory Note No. 5

APPENDIX

Table A1 Numerical check values for the water part computed from $g^W(p, T)$, Eq. (4), and its derivatives, for the saline part computed from $g^S(p, T, S)$, Eq. (5), and its derivatives, for the seawater properties computed from the Gibbs function $g(p, T, S)$, Eq. (1) and its derivatives and for selected seawater properties of Table 1 at given points (p, T, S)

Properties at $p = 0.101325$ MPa, $T = 273.15$ K, $S = S_n = 0.03516504$ kg kg⁻¹

Quantity	Water part	Saline part	Property of seawater	Unit
g	$0.101\ 359\ 446 \times 10^3$	$-0.101\ 342\ 742 \times 10^3$	$0.167\ 04 \times 10^{-1}$	J kg ⁻¹
$(\partial g / \partial p)_{T,S}$	$0.100\ 015\ 572 \times 10^{-2}$	$-0.274\ 957\ 224 \times 10^{-4}$	$0.972\ 659\ 995 \times 10^{-3}$	m ³ kg ⁻¹
$(\partial^2 g / \partial p^2)_{T,S}$	$-0.508\ 885\ 499 \times 10^{-12}$	$0.581\ 535\ 172 \times 10^{-13}$	$-0.450\ 731\ 982 \times 10^{-12}$	m ³ kg ⁻¹ Pa ⁻¹
$(\partial g / \partial T)_{p,S}$	0.147 711 823	-0.147 643 376	$0.684\ 47 \times 10^{-4}$	J kg ⁻¹ K ⁻¹
$(\partial^2 g / \partial T^2)_{p,S}$	$-0.154\ 473\ 013 \times 10^2$	0.852 861 151	$-0.145\ 944\ 401 \times 10^2$	J kg ⁻¹ K ⁻²
$(\partial^2 g / \partial p \partial T)_S$	$-0.676\ 992\ 620 \times 10^{-7}$	$0.119\ 286\ 787 \times 10^{-6}$	$0.515\ 875\ 254 \times 10^{-7}$	m ³ kg ⁻¹ K ⁻¹
$(\partial g / \partial S)_{p,T}$	0	$0.639\ 974\ 067 \times 10^5$	$0.639\ 974\ 067 \times 10^5$	J kg ⁻¹
$(\partial^2 g / \partial p \partial S)_T$	0	$-0.759\ 615\ 412 \times 10^{-3}$	$-0.759\ 615\ 412 \times 10^{-3}$	m ³ kg ⁻¹
v	$0.100\ 015\ 572 \times 10^{-2}$	$-0.274\ 957\ 224 \times 10^{-4}$	$0.972\ 659\ 995 \times 10^{-3}$	m ³ kg ⁻¹
u	$-0.403\ 288\ 161 \times 10^{-1}$	$-0.582\ 279\ 494 \times 10^{-1}$	$-0.985\ 567\ 655 \times 10^{-1}$	kJ kg ⁻¹
h	$0.610\ 119\ 617 \times 10^{-1}$	$-0.610\ 139\ 535 \times 10^{-1}$	$-0.199\ 18 \times 10^{-5}$	kJ kg ⁻¹
s	$-0.147\ 711\ 823 \times 10^{-3}$	$0.147\ 643\ 376 \times 10^{-3}$	$-0.684\ 47 \times 10^{-7}$	kJ kg ⁻¹ K ⁻¹
c_p	$0.421\ 943\ 034 \times 10^1$	-0.232 959 023	$0.398\ 647\ 132 \times 10^1$	kJ kg ⁻¹ K ⁻¹
w	$0.140\ 243\ 979 \times 10^4$	- ^a	$0.144\ 907\ 123 \times 10^4$	m s ⁻¹
μ_W	0.101 359 446	$-0.235\ 181\ 411 \times 10^1$	$-0.225\ 045\ 466 \times 10^1$	kJ kg ⁻¹

^a This value cannot be computed from g^S alone because it is a nonlinear expression in g

History and further procedure

October 2015: Errors in Table A1 of AN5 discovered by Konstantin Orlov and information to Hans-Joachim Kretzschmar

March 2016: Incorporation of corrections into AN5 by the authors

March 2016: Corrected version of AN5 was sent to Allan Harvey und Ingo Weber



Aim: Formal consideration of the Editorial changes to the Advisory Note in Dresden