d) The Boundary Equation $p_{s,3}(h)$

The boundary equation $p_{s,3}(h)$ has the following dimensionless form:

$$\frac{p_{s,3}(h)}{p^*} = \pi(\eta) = \sum_{i=1}^{14} n_i (\eta - 1.02)^{I_i} (\eta - 0.608)^{J_i} \quad , \tag{2.18}$$

where $\pi = p/p^*$ and $\eta = h/h^*$ with $p^* = 22$ MPa and $h^* = 2600$ kJ kg^{-1}. The coefficients n_i and exponents I_i and J_i of Eq. (2.18) are listed in Table 2.29.

Table 2.29 Coefficients and exponents of the boundary equation $p_{s,3}(h)$ in its dimensionless form, Eq. (2.18)

i	I_i	J_i	n_i	i	I_i	J_i	n_i
1	0	0	0.600 073 641 753 024	8	8	24	$0.252\,304\,969\,384\,128 \times 10^{18}$
2	1	1	$-0.936\,203\,654\,849\,857 \times 10^{1}$	9	14	16	$-0.389\,718\,771\,997\,719 \times 10^{19}$
3	1	3	$0.246\,590\,798\,594\,147 \times 10^{2}$	10	20	16	$-0.333\,775\,713\,645\,296 \times 10^{23}$
4	1	4	$-0.107\,014\,222\,858\,224 \times 10^{3}$	11	22	3	$0.356\,499\,469\,636\,328 \times 10^{11}$
5	1	36	$-0.915\,821\,315\,805\,768 \times 10^{14}$	12	24	18	$-0.148\,547\,544\,720\,641 \times 10^{27}$
6	5	3	$-0.862\,332\,011\,700\,662 \times 10^{4}$	13	28	8	$0.330\,611\,514\,838\,798 \times 10^{19}$
7	7	0	$-0.235\,837\,344\,740\,032 \times 10^{2}$	14	36	24	$0.813\,641\,294\,467\,829 \times 10^{38}$

The equation $p_{s,3}(h)$, Eq. (2.18), describes the saturated-liquid line and the saturated-vapour line including the critical point in the following enthalpy range, see Fig. 2.5:

$$h'(623.15\ \text{K}) \le h \le h''(623.15\ \text{K}),$$
$$\text{where } h'(623.15\ \text{K}) = h_1(p_s(623.15\ \text{K}), 623.15\ \text{K}) = 1.670\,858\,218 \times 10^3\ \text{kJ kg}^{-1}$$
$$\text{and } h''(623.15\ \text{K}) = h_2(p_s(623.15\ \text{K}), 623.15\ \text{K}) = 2.563\,592\,004 \times 10^3\ \text{kJ kg}^{-1}.$$

Computer-Program Verification. To assist the user in computer-program verification of Eq. (2.18), Table 2.30 contains test values for calculated pressures.

Table 2.30 Pressure values calculated from the boundary equation $p_{s,3}(h)$, Eq. (2.18), for selected specific enthalpies [a]

Equation	h [kJ kg^{-1}]	p [MPa]
$p_{s,3}(h)$, Eq. (2.18)	1700	$1.724\,175\,718 \times 10^{1}$
	2000	$2.193\,442\,957 \times 10^{1}$
	2400	$2.018\,090\,839 \times 10^{1}$

[a] Programmed functions should be verified using 8 byte real values for all variables.

Note. For points extremely close to the boundary between the single-phase region 3 and the two-phase region 4, the following procedure is recommended. When calculating the pressure with the $p_{s,3}(h)$ equation, Eq. (2.18), its numerical inconsistency of 0.00043% in pressure with respect to the basic equation $p_s(T)$, Eq. (2.13), has to be considered. Due to this minor inconsistency the result of the calculated pressure should be corrected to $p_{s,3} = p_{s,3}(h)\,(1 - \Delta p/p)$, where $\Delta p/p = 4.3 \times 10^{-6}$. This procedure ensures that (p,h) points extremely close to the two-phase region are correctly assigned to the single-phase region and not falsely to the two-phase region.