H_2O phase equilibrium line from the triple point to the critical

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A system of equations (SE) has been developed that describes the saturated vapor pressure, the density of saturated liquid and saturated vapor. Within the framework of the proposed approach, the requirements of the theory of renormalization groups (RG) are met, and the saturation line is described in accordance with the Yang-Yang model. The Yang-Yang model has been tested on the example of describing the saturation line of a number of technically important substances: sulfur hexafluoride, argon, etc. [1], and liquid metals [2]. To calculate the density of saturated vapor, ρ_v, in the SE the Clapeyron-Clausius equation was used:

$$\rho_v^{-1} = r_0 p_s'(T) T^{-1}, \tag{1}$$

where p_s is the saturated vapor pressure; r_0 is the "apparent" heat of vaporization associated with the heat of vaporization r by the dependence: $r = r_0(1 - \rho_v/\rho_l)$; ρ_l is the density of the saturated liquid.

When searching for the SE coefficients, the RG theory for asymmetric systems was used [3]. Water properties were calculated on the basis of the SE: p_s, ρ_l, ρ_v and r in the temperature range from T_t to T_c, where T_t and T_c are the triple point temperature and the critical temperature. It is shown that the average diameter of the water is positive, $d_f > 0$, at each point of the saturation line at $T < T_c$. This favorably distinguishes the SE from the model [4].

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