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Supplementary Backward Equations $p(h, s)$ for the Critical and Supercritical Regions (Region 3), and Equations for the Two-Phase Region and Region Boundaries of the IAPWS Industrial Formulation 1997 for the Thermodynamic Properties of Water and Steam

When steam power cycles are modeled, thermodynamic properties as functions of enthalpy and entropy are required in the critical and supercritical regions (region 3 of IAPWS-IF97). With IAPWS-IF97, these calculations require cumbersome two-dimensional iteration of temperature T and specific volume v from specific enthalpy h and specific entropy s . While these calculations are not frequently required, the computing time can be significant. Therefore, the International Association for the Properties of Water and Steam (IAPWS) adopted backward equations for $p(h, s)$ in region 3. For calculating properties as a function of h and s in the part of the two-phase region that is important for steam-turbine calculations, a backward equation $T_{\text{sat}}(h, s)$ is provided. In order to avoid time-consuming iteration in determining the region for given values of h and s , equations for the region boundaries were developed. The numerical consistency of the equations documented here is sufficient for most applications in heat-cycle, boiler, and steam-turbine calculations. [DOI: 10.1115/1.2719267]