Analysis of the Stratified Storage Model from the New prEN 15 316-5 : 2023

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Abstract
In 2017, CEN (European Committee for Standardization) introduced a 2nd edition of standards for the assessment of buildings technical system energy performance (EN 15 316 series of standards) supporting the Energy Performance of Buildings Directive. The main novelty is the introduction of an hourly time step calculation methods and of the new standard which takes into account dynamic temperature variations within the storage tank (EN 15 316-5 : 2017). This standard contained many errors in the provided energy balance equations and ambiguities related to calculation procedure. Therefore, the revision of this standard has been made (prEN 15 316-5 : 2023) and is now under approval of the relevant technical committee CEN/TC 228/WG4. prEN 15 316-5 : 2023 comprises two methods applicable to the different types of water-based storage systems and related control system. Particularly interesting is the Method A, which considers the temperature stratification within the storage tank. In the Method A several assumptions, concerning the modelling of water flow through the tank, homogeneity of water temperature within the layer, conduction and convection between the layers, had to be implemented in the calculation procedure.
Currently, there are no analyses in the open literature that validate the introduced assumptions. To address this, the present paper provides a comprehensive analysis of the method accuracy in the case of solar storage by comparison with the results obtained by CFD simulations. Furthermore, the influence of the temperature distributions within the storage tank obtained by 1-layer (Method B of prEN 15 316-5 : 2023), 4-layer, 5-layer model and CFD simulation on the obtained solar collector thermal efficiency is given. The results show are no significant differences in calculated thermal efficiencies, except for the 1-layer model where the differences are up to 8% relative to the CFD simulation.

Keywords: *solar storage tank, stratified storage model, solar system, CFD simulation, solar collector thermal efficiency*