

UNISOL – solar combistore evaluation and optimization.

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Abstract

In the frame of UNISOL project, a test bench was installed to perform tests of a combistore which includes a two-way heat exchanger already submitted to a national patent application. The present work describes the main characteristics of the test bench installed and the tests performed with the objective of optimization of the configuration of the inner storage tank of the combistore (two way heat exchanger), used for DHW pre-heating or as back-up of the space heating. Tests according to EN 12977-3:2012 were performed in order to evaluate distinct configurations of the inner storage tank. Tests according to EN 12977-4:2012 were also performed for characterization of the complete combistore. Long-term performances of solar thermal systems using these combistore are presented.

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1. Introduction

UNISOL is a national project aiming at the development of an innovative, autonomous and intelligent universal system for management and accumulation of solar heat that can practically use any solar collector in the market [1]. The system will simultaneously pre-heat domestic water (DHW) and space heating (SH). The main component is a combistore which includes a two-way heat exchanger already submitted to a national patent application (patent n. 10561) [2].

A test bench was installed in order to evaluate and optimize the performance of the combistore developed in the frame of UNISOL project [1]. The present work describes the main characteristics of the test bench installed.

Numerical simulations were performed in the software TRNSYS [3] in order to test the selected numeric model Type 340 [4] and optimization algorithm available in GENOPT [5] according to EN 12977-3:2012 [6], respectively, Annex A and C. The errors were calculated according to equations in Annex B of the referred standard and it was possible to conclude that the selected methodology is able to fulfill EN 12977-3:2012 [6] requirements [7].

Two storage prototypes were tested according to EN 12977-3:2012 [6]. The prototypes will be referred as prototype 1 and 2. The objective of these tests was to evaluate the heat transfer capacity between the inner tank and the exterior tank. Only prototype 2 was tested according to EN 12997-4:2012 [8].

Two CFD simulations [9] were also performed to evaluate the heat transfer capacity of prototype 2 considering different inlet and outlet positions. Future work will be testing of prototype 2 with changed positions of inlet and outlet of the heat exchanger since CFD simulations showed that this solution would have a better heat transfer capacity.

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