Chapter 5
A Reliability Test Installation for Water Heating Solar Systems:
Requirements and Design According to the European Norm 12976

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ABSTRACT

This chapter analyzes the requirements that a test installation design must comply with in order to carry out the test procedures of prefabricated systems mentioned in a previous chapter and based on the norm EN 12976. In other words, the authors consider for the test installation design, firstly, the requirements that the hydraulic circuit of such an installation must meet, followed by the specifications required by the custom-built systems; all of this has the aim of certifying that the characteristics of the prefabricated system are the applicable ones. Subsequently, the chapter then directly proceeds to design a test installation, which is to be later compared to a real installation.

INTRODUCTION

This chapter continues with the statements provided in the previous chapter "An overview to thermal solar systems for low temperature: Outlining the European Norm 12976". In order to propose a reliability test installation for solar systems, it is necessary to know the requirements for such test installations (González-Prida, 2002). These requirements come from the international norm ISO 9459-2, which makes reference to the European Norm EN 12976.

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Hydraulic Circuit

Pipes

Pipes must be constituted of a material which allows the use of water as the working fluid, as well as to be able to withstand maximum temperatures limited to 95 °C. Considering that most of the solar energy installations utilize pipes made of copper to prevent galvanic corrosion, all the test installation circuits must be made out of this material. In order to minimize the possible effects of the environment on the temperature of the water that goes into the prefabricated system, the longitude of the related pipes will be the minimum permitted; trying that the distance between the outlet temperature regulator[1] (upstream to the prefabricated system) and the inlet of such system is the allowable minimum possible[2]. A drainage pipe must be installed in a fashion that is the bifurcation of the inlet pipes into the prefabricated system, just before such entrance.

Insulation

The circuit must be insulated with an outdoor reflective coating, in this manner, thermal losses will be less than 0,2 W/K. Similarly, the pipes that connect the temperature sensors, in and out of the system, must also be protected with a reflective coating so that the loss or gain of temperature in each section does not exceed the 0,01 K of the test conditions.

Working Fluid

Water is used as the working fluid for the test installation. The quality of the water extracted from the prefabricated system must not have any adverse effects and must be fit for human consumption. However, the water used in the tests must be able, under any circumstances, to be used for human consumption.

Mixing Devices

The mixing devices (for example orifices, elbow joint or mixers) have these purposes:

- That the meassure in the temperature sensors corresponds to that of a homogeneous fluid,
- That the temperature of the cold water coming in can be controlled in order to carry out tests under different conditions,
- That the temperature of the hot water going out can be limited.

In reference to the first case, it will be necessary to install mixing devices immediately upstream of the temperature sensors (Fisch 1995). For that, is recommended that the location of the temperature sensors and mixing devices (joints in this case) as they are shown in the following illustration (Figure 1).

In the second case, and as an alternative to a temperature regulator, the degree of fluid mix coming from a hot water tank and from a cold one, are both kept at a constant temperature and can be controlled, thus obtaining the desired temperature of the fluid as it enters the system.

Finally, the third case refers to systems in which the hot water temperature in the consumption points can exceed the 60 °C maximum and therefore it must be limited. To do this, the assembly instruction