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Demonstrating of the performance of a Solabcool® units applied in the field

Henk A. de Beijer[a]* , Jacco Duim[a]

[a]*SolabCool BV, Stenograaf 1, Duiven 6921 EX, The Netherlands*

Abstract

This paper presents the performance of two adsorption chillers applied in two different projects. These adsorption chillers are driven by solar heat or waste heat, i.e. district heat. An all in one adsorption unit, with an integrated dry cooler and a patented multiple-way valve was placed at a dwelling. The other adsorption unit, which is scalable, was placed at an incinerator plant. The performance measured at the two projects was then compared with a reference test of the adsorption unit that were performed in our test facility. It was found that the performance of the adsorption units in the field was equivalent to the performance obtained in the reference test under static conditions.

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Keywords: Fully intergrated adsorption cooling system; Adsorption chiller field test; Solar/waste heat driven

1. Introduction

The increasing prosperity of the world population is causing an increased demand for residential cooling. Data obtained in studies on the impact of cooling in the built environment, indicates its significant contribution to global warming [1,2]. Adsorption chillers driven by solar heat or waste heat can contribute to a more sustainable built environment. Adsorption chillers have many possible applications and a large scale of heat sources is available in the built environment, e.g. district heating, solar heating, etc. However, introducing adsorption chillers in dwellings,

* Corresponding author. Tel.:+312 63 12 02 89.
E-mail address: h.debeijer@ares-rtb.nl

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offices and small industry processes is complex and often requires the integration of multiple system, which leads to an increase in costs.

One way to increase the use of sustainable adsorption cooling in the built environment is to offer an integrated all in one adsorption chiller for in dwellings and an easily expandable adsorption chillers for offices and small industry processes. The company SolabCool® has developed the SolabChiller® for dwellings and the SolarPump® for offices and small industry processes. This paper presents the performance of the SolabChiller® in a dwelling and an the performance of the SolabPump® in an office and compare these results with the performance of the reference measurement.

The seasonal thermal COP of adsorption units applied for cooling are obtained in other studies under practical conditions, in these studies the seasonal thermal COP is approximately 0.58 a 0.60 [3,4]. The SolabChiller® and SolabPump® are applied at a dwelling and at a office, based on their full load performances and their corresponding thermal COP obtained at the test facility at SolabCool®. Goal of this study is to compare the seasonal COP obtained in the two demonstration projects with the thermal COP obtained at the full load tests at SolabCool®.

2. Technology and product development

Based on the expected growth of cooling in the residential area[1,2] two adsorption units are developed:

- The SolabChiller: an integrated adsorption chiller with a cooling power of approximately 5 kW, for the application in dwellings;
- The SolabPump: an up scalable adsorption chiller for the application in offices and small industry processes, with a cooling power of approximately 10- 50 kW.

The SolabChiller® is developed to reduce the installation costs and time of an adsorption unit in the residential area. The SolabChiller® is equipped with an integrated dry cooler and a patented multiple-way valve to maximize the efficiency of the hydraulic circuit. The only installation steps required for a SolabChiller® are connecting the heat source and the cooling circuit of the dwelling to the respective circuits of the SolabChiller®. In Figure 1 a demonstration project is displayed with the SolabChiller® installed at a dwelling in Arnhem, The Netherlands. The driving heat source is in this demonstration project is the district heating of the incineration plant AVR in Duiven.

Fig. 1: The hydraulic connections of the Solabchiller® before installation. Connections on the left side are for the cooling circuit of the dwelling and on the right side for the heat source.

The up scalable adsorption unit for offices and small industrial processes is developed to use excess heat for climate control and temperature control of small scale industrial processes. The Solabpump® is easily scalable and can therefore be adaptable to suit a variety of different industrial processes. To increase the overall efficiency of the SolabPump® the same patented multiple valve is utilized in the hydraulic circuits. In Figure 2 a demonstration