
Multifamily-house building

Beneficiary:

Multifamily-house building
Valladolid
Spain

Consultant:

ROTARTICA
FAGOR ELECTRODOMÉSTICOS
IKERLAN

Subject of Feasibility Study:

Check of possibilities to install a Solar Combi+ System in a multifamily-house building.

Deliverable D6.12_SP2 (English)

EIE project SolarCombi+, Grant Agreement no. EIE/07/158/SI2.466793

1. Object:

The feasibility study shows the basic definition of a Solar Combi+ installation, for combined heating, cooling and DHW production for a multifamily house in Valladolid (Spain).

2. Building description:

The building is located in Valladolid in the centre of Spain, so the climatic conditions are Continental.



Figure 1 General geographical location



Figure 2 Geographical location (in detail)

3. Customer requirements and basic data:

The initial data has been given by the Responsible of the Residential Building. Main characteristics are resumed below:

- 4 floors building, with a total of 11 dwellings.
- Maximum occupancy profile: around 1-2 people/dwelling.
- Room area: 36 m²
- Climatization total area: 396m²
- Average monthly occupancy: 50%
- Conventional energy used for heating and cooling: A boiler of 60 kW feed by wood pellets will be used as an auxiliary heating supply when the demand is higher than the solar coverage.
- DHW use: kitchen and bathroom.
- Heat rejection possibility: 21.000 l well

Climatic data, water temperature and solar radiation data in Valladolid at least should be take into account, in order to analyze and define a Solar Combi + System.

Table 1: Average ambient temperature (°C)

	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic
T°C	4.0	6.1	8.4	10.1	13.8	18.1	21.7	21.6	18.1	12.8	7.7	5.0

Table 2: Relative Humidity (%)												
	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic
Hr	%	83	72	62	62	61	54	47	49	56	69	78

Table 3: Solar irradiation on horizontal (En Mj/m ² /día)												
	Ene	Feb	Mar	Abr	May	Jun	Jul	Ago	Sep	Oct	Nov	Dic
Rad.	4,5	10,4	12,9	16,9	19,4	22,8	24,9	22,8	16,0	10,9	6,1	3,6

4. Installation definition:

So, the installation defined for this application has the main basic data:

- Solar Flat Plate collectors: 30 units. Total useful area: 75 m².
- Solar and DHW storage: 3.000 l.
- Absorption machine: 4 units of Rotartica SOLAR 045, 4,5 kW cooling nominal capacity each one.

Taking into consideration the customer requirements and initial data, dynamic simulation give as a result an estimation of the heating, cooling and DHW requirements of the defined installation and are summarized as follows:

CONSUMPTION	kWh
DHW and Heating	21.600
Cooling	13.800

Table 4 DHW, heating and cooling consumption

5. Installation description:

The installation described below is based on a SolarCombi + system, for heating, cooling and DHW production for a multi-family building in Valladolid. The air-conditioned area is over a 396 m².

The basic characteristic of the installation, system and components definition and description are given below:

- Solar collectors system.
- Solar energy storage system.
- ROTARTICA absorption machine.
- Heat rejection system.
- Pumping system.
- Purge components.
- Expansion and security system.
- Auxiliary system.
- Hydraulic piping.
- Distribution system (circuits and components).
- Control and regulation system.

5.1.- Basic configuration

The proposed configuration is show in the following figure:

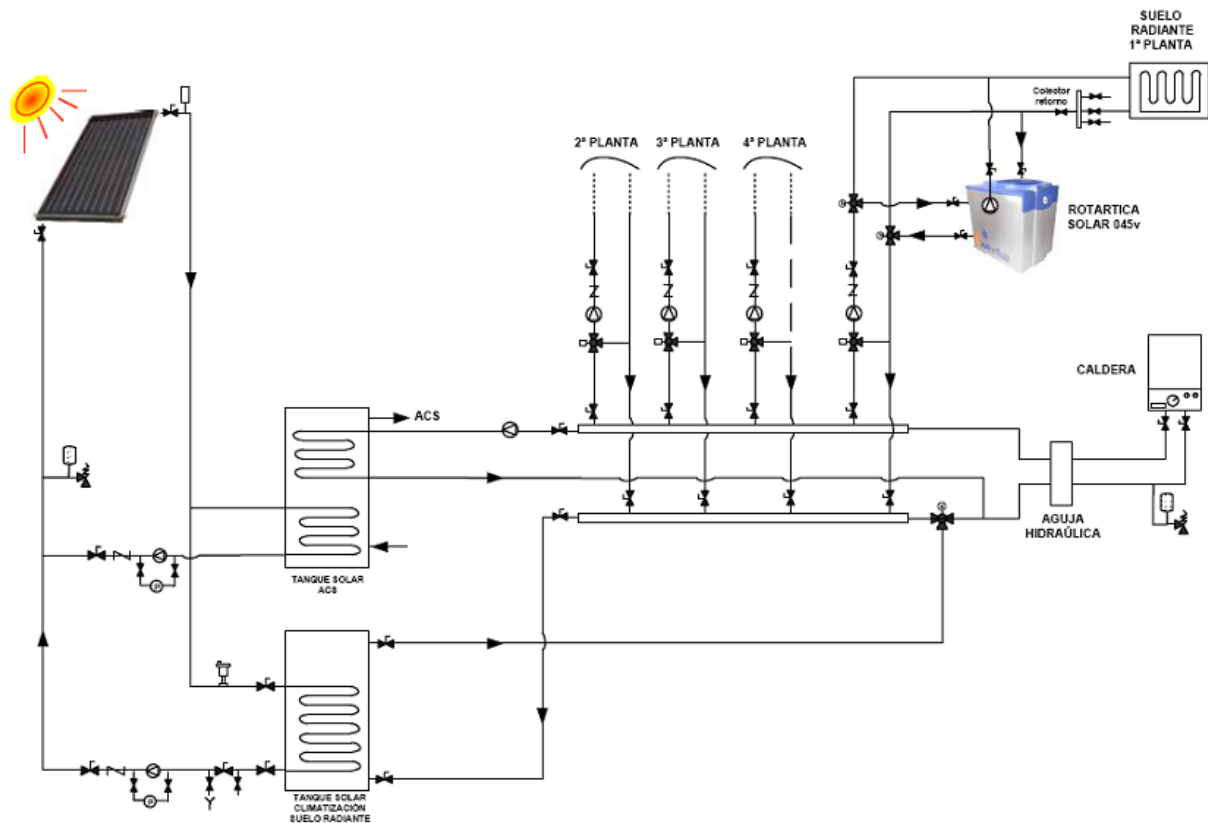


Figure 3: Installation configuration scheme

5.2.- Solar Collector

Solar collector system will be able to collect the solar energy and use the heat of the water for other purposes, such as heating, DHW and as a input energy for the absorption machine.

The solar collector field is around 75 m² area, with Viessman flat plate collectors (Vitosol model 100).

5.3.- Solar Storage Tank

A solar storage tank is able to storage hot water from the solar collectors, so it will be possible to have hot water when the demand is not in accordance with the hot water generation.

A 3000 l solar storage tank has been defined for heating and cooling applications, and its properties allows to work up to 110°C water temperature. An extra storage tank has been defined for DHW consumption purposes.

Solar storage tanks and other hydraulic and electric components will be placed on an auxiliary area.

5.4.- ROTARTICA absorption machine

ROTARTICA SOLAR 045 absorption machine will be placed also in the auxiliary area and basically the basic technical characteristic of the machine are given below:

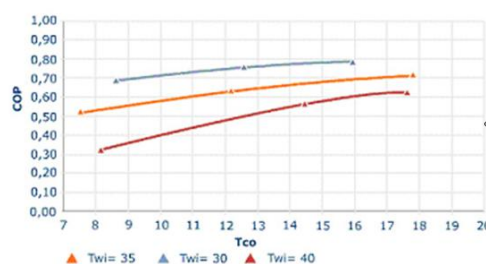


Figure 4: Rotartica COP

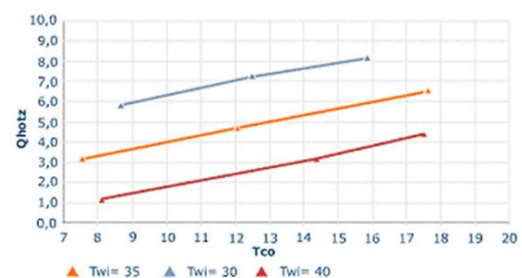


Figure 5: Rotartica Cooling capacity

PERFORMANCE SPECIFICATIONS	
Cooling nominal	4.5 kW
COP	0.7
Solar circuit T ^a	90° C

Table 5: Performance Specifications

Nominal performance of the absorption machine is also schematically represented in the figure 6.

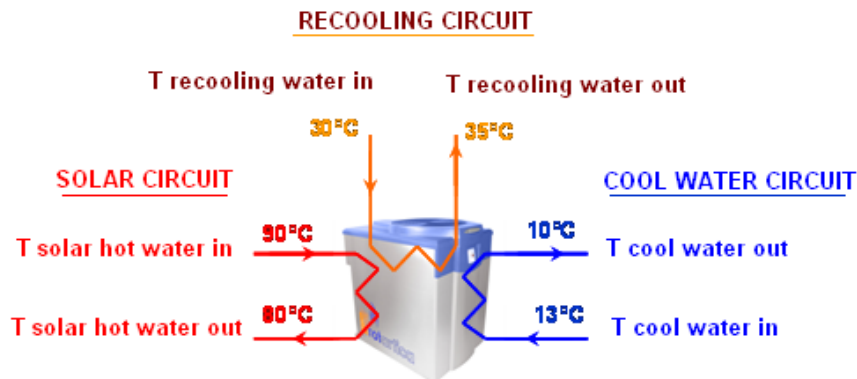


Figure 6: Esquema básico de funcionamiento de la máquina de absorción Rotartica

It is important to take into consideration Rotartica machine nominal design parameter, such as flow-rates and pressure drops in the three circuits, in the definition of the components of the system.

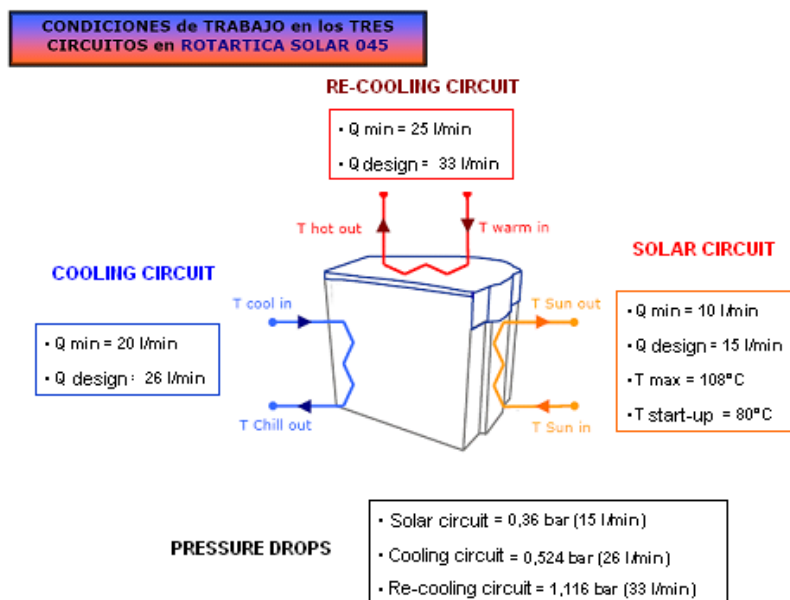


Figure 7: Performance nominal conditions for Rotartica 045 absorption chiller

5.5.- Heat Rejection system

Absorption machine heat rejection system will be against a well and also with a dry air cooler. Other components, such as pumps, filters heat exchanger and others, will be located in the pumping auxiliary area.