Combisol project

Solar Combisystems Promotion and Standardisation

Suggested Contents for Training on Solar Combisystems for Installers

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Contents

1. Introduction

This document gives an introduction in which topics are considered essential to include in training on solar combisystems. It has been derived by the participants of Combisol based on many years of experience in training in general and on solar combisystems specifically.

The contents assume that the students already have a basic understanding of solar hot water systems as well as general HVAC knowledge.

This document is split up into two sections:

- Essential contents for short course, where the most essentials things are listed. These should always be included in courses dealing with solar combisystems. The depths of content should be matched to the length of the course.
- Suggested extra content to give the participant a deeper understanding of what is required for the good function of a solar combisystem and what can go wrong in installations.

2. Essential Contents (Short Course)

This list of contents assumes that the students have already gained a basic knowledge of solar heating systems and HVAC components.

<u>Characteristics of loads (DHW and space heating)</u>

Differences in heating rates, temperatures and flows as well as typical profiles

Example literature: IEA-SHC Task 26 Handbook, chapter 5 [1]

<u>Differences between solar DHW and combisystems</u>

Differences in loads, types of circuits required, heat exchangers

Example literature: IEA-SHC Task 26 Handbook, chapter 5 [1]

<u>Types of DHW preparation</u>

Tank in tank, immersed heat exchangers and external flat plate heat exchangers and their advantages and disadvantages.

Example literature: Combisol updated state of the art report, D2.4, chapters 2-7 [2]

<u>Difference between buffer and DHW stores</u>

Requirements for DHW store materials (fresh water), relative costs

Example literature: IEA-SHC Task 32 Handbook, chapter 5 [3]

Different thermal zones in a solar combistore

At what heights should you connect different heat sources and sinks.

Example literature: IEA-SHC Task 32 Handbook, chapter 5 [3]

Connection and types of auxiliary heaters

Auxiliary heater heating the store or being preheated by the store.

Example literature: Combisol updated state of the art report, D2.4 chapters 2-7 [2] as well as IEA-SHC Task 26 Handbook, chapter 5 [1]

Common system designs

The six different characteristic designs of Combisol. Examples of compact systems.

Example literature: Combisol Updated state of the art report, D2.4 [2] as well as IEA-SHC Task 26 Handbook, chapter 5 [1]

Stagnation protection

Degradation of glycol at high temperatures, the basic concept of the boil-back approach (emptying the collector by boiling), stages in stagnation, how to calculate the correct system pressure, prepressure in the expansion vessel and the size of the expansion vessel as well the need for cooling.

Example literature: [1 (chapter 8.2), 4-7]

Control, including items important in stagnation control

Starting and stopping the collector in normal operation. Protecting from overheating by night cooling of the store via collector, hindering restart of the collector with high temperatures in the collector. Charging of the store from auxiliary: two sensor and one sensor control.

Example literature: Viessman technical solar thermal systems, chapter D1.2 [7]

Sizing of solar combisystems (collector, store, piping)

Variation of savings with collector area and store size, two store and one store systems, size of pipes, rules of thumb for store size dependent on collector size.

Example literature: Combisol guidelines, IEA-SHC Task 26 handbook, chapter 9 [1]

Dependence of savings on temperature and size of auxiliary heated volume in store

Energy saving are less for higher set temperatures for the auxiliary heated volume in the store as well as with an increase of this volume. The available DHW capacity increases as savings decrease.

Example literature: IEA-SHC Task 26 handbook, chapter 9 [1]

Heat losses from stores and pipes and how to prevent them

Reduction of heat losses from the stores and pipes are critical to achieving a good performance in practice with solar combisystems. Thermosiphon breaks, non-return valves and good store insulation without thermal bridges are required.

Example literature: Combisol guidelines [1 (chapter 9), 3 (chapter 7), 8, 9, 10]. Significant amount of material available from SPF-HSR at www.solarenergy.ch.

Legionella and national regulations for its avoidance

Legionella growth and destruction. Methods for prevention and national regulations.

Example literature: Legionella in combisystems tanks [11].

3. Suggested Extra Contents (Longer Course)

In this chapter extra contents for a longer course are suggested. Which of the topics are taken into a course depends on the target group for the course. Much of the material can be found in the handbooks from IEA-SHC Tasks 26 [1] and 32 [3] as well as Combisol reports. The Viessman technical guide [7] also covers several of the topics as does the VDI guide for solar DHW systems [12].

- Solar radiation and its variation in time and place.
- Stratification in tanks and how it is achieved.
    - Internal heat exchangers.
    - Direct connections.
    - Stratifying units.
- Comparison of low and high flow systems.
- Different types of system design.
- Integration of collectors into roof and façade.
- Collector field design and calculations.
- Test methods for solar combisystems.
- Solar combisystems for multi-family houses.
- System simulation with design tools (T-sol, Polysun etc).
- Guaranteed solar results (monitoring).
- Tendering processes for larger systems.

4. Possible Literature

In this section a list of possible literature is given. This has been restricted to the English language. You can check the database list of materials on solar combisystems (excel sheet) at the Combisol website for literature in other languages as well as other resources in English.

[1] Weiss, W., ed., *Solar Heating Systems for Houses - A Design Handbook for Solar Combisystems*. Vol. 1. 2003, James & James: London, UK. ISBN: 1-902916-46-8.

[2] Thur, A., J. Breidler, and G. Kuhness, EU Project Combisol public deliverable: *D2.4: Updated State of the Art Report of Solar Combisystems Analysed within CombiSol*, AEE Intec, Gleisdorf, Austria. www.combisol.eu. 2010

[3] Hadorn, J-C., ed., *Thermal energy storage for solar and low energy buildings - State of the art*, 2005, University of Lleida: Lleida, Spain. ISBN: 84-8409-877-X

[4] Scheuren, J. and M. Kirchner. *Analysis and Prediction of the Steam-Producing Power in Large-Scale Collector Arrays under Stagnation Conditions*. in *Proc. Eurosun 2008*. Lisbon. 2008

[5] Scheuren, J. and W. Eisenmann ISFH Project Report 0329268A: *Stagnationsuntersuchungen in den Kollektorkreisen hochdimensionierter großer thermischer Solaranlagen*, ISFH, Hameln, Germany. 2007

[6] Hausner, R. and C. Fink Technical report: *Stagnation Behaviour of Solar Thermal Systems*, IEA-SHC Task 26 Solar Combisystems, Paris, France.http://www.iea-shc.org/task26. 2003

[7] Viessman: *Technical Guide Solar Thermal Systems*, Viessman GmbH & Co KG, Allendorf, Germany. 2009

[8] Thur, A. et al., EU project Combisol public deliverable: *D2.1: Criteria for best practice*, AEE Intec, Gleisdorf, Austria. www.combisol.eu. 2010

[9] Thur, A. et al., EU project Combisol public deliverable: *D2.3: Guidelines for design and dimensioning of solar combisystems*, AEE Intec, Gleisdorf, Austria. www.combisol.eu. 2010

[10] Vogelsanger, P. Losses of pipes connected to stores and the effect of heat traps – result of literature search, SPF-HSR, Rapperswil, Switzerland. www.solarenergy.ch. 2006.

[11] Cabeza, L., IEA-SHC Task 32 report: *Legionella in Combisystems Tanks*, IEA-SHC, Paris, France. www.iea-shc.org . 2005.

[12] VDI, VDI 6002 Blatt 1: 2004-9: *Solar heating for domestic water – General principles, system technology and use in residential buildings*. VDI, Dusseldorf, Germany. 2004.