Task 45 Large Systems

Requirements & guidelines for collector loop installation

Subject:	**Guidelines for requirements for collector loop installation including precautions for safety and expansion**
Date:	December 2014
Description:	State of the art of **hydraulics** (collector and collector array hydraulics) and **safety** (including stagnation) aspects of the primary solar loop is presented and analysed in a theoretical as well as practical framework.
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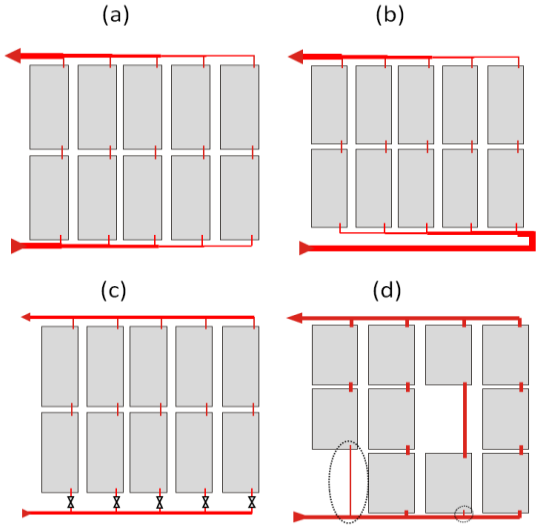
Download possible at:	http://task45.iea-shc.org/fact-sheets

Introduction

The state of the art of **hydraulics** (collector and collector array hydraulics) and **safety** (including stagnation) aspects of the primary solar loop is presented and analysed in a theoretical as well as practical framework, also referring to **examples** of successfully implemented projects. It is based on international know-how collected by IEA networking activities, presented in a condensed form in this document.

Collector types and hydraulic array connections

An overview is given on different collector types as well as on their distribution in the international context. Different types of array hydraulics as well as current issues concerning the hydraulics (flow distribution, etc.) of individual collectors and collector arrays are discussed. The influence of certain parameters (pipe diameters, pipe length, production constraints on T-pieces, etc.) on the collector array and on the mass flow on different levels is analysed.



Example: Methods for achieving a homogeneous mass flow distribution. (a) Adjustment of the supply and return pipes diameters. (b) Tichelmann connection in combination with adjustments to the pipe diameters. (d) Installation of mechanical balancing valves. (d) Adjustment of the collector connecting pipe diameters.

Furthermore, a method is presented which allows for a simple technical assessment of different hydraulics specific to each plant by using a set of indicators.

Safety

The chapter on safety aspects presents the different methods and solutions for preventing or handling stagnation, taking into account that there are significant differences between large-scale and smaller combi systems on this matter. Apart from stagnation, further safety issues considering large-scale plants and their respective solutions are discussed. An overview on the different types of primary loops based on already implemented large-scale solar thermal projects is given. Variations in the selection of collectors, hydraulic connections and the differences in the operation (flow speed, pressure loss, etc.) of the plants are analysed.

Example: Table below gives measures for handling and preventing stagnation.

	Stagnation handling	Overheating prevention
"passive" measures	**All system sizes:** • Appropriate expansion vessel design • Use of temperature-resistant solar loop components • Drain-Back concepts (special designed collectors and collector field hydraulics needed) **Small to medium systems (< 100 to 700 $kW_{th,p}$):** • Dissipators based on heat transfer to air (e.g.: finned tube heat exchanger) [< 350 $kW_{th,p}$] • Dissipators based on heat transfer to water (e.g.: stagnation cooler) [100 - 700 $kW_{th,p}$]	**All system sizes:** • Solar thermal collectors with automatic cooling of the absorber (without use of electricity) • Temperature dependent changes of optical properties of absorber coatings or glazing
"active" measures	**System "Ritter Solar" (with evacuated tube collectors):** • The German company Ritter XL Solar provides a special hydraulic system concept with evacuated tube collectors also for large scale applications where stagnation is an accepted operating mode • No "active" cooler is needed but active control, pumps and motor-operated valves	**Medium to large systems (e.g. > 350 $kW_{th,p}$):** • "active" cooler solutions in the solar primary loop **Systems with flat plate collectors – all system sizes** • night cooling **Systems with concentrating and tracking collectors – all system sizes** • automatic „defocussing" of the concentrator mirrors