

Standard-Metallwerke

Application recommendation
when using
S-Life Solar aluminium tubes
in solar thermal systems

Issued 22nd June 2012

Introduction

Continually increasing prices for conventional materials is the driving force behind the use of alternative materials, a fact that applies in particular to absorbers. Following the introduction of absorber plates made of aluminium, the possibility was examined to produce absorber tubes from other materials as well. And because aluminium tubes have become widely used in motor vehicles the idea of applying the experiences gained to other sectors of industry was not too far-fetched. In practice, it quickly proves to be the case that there are no standards specifying corrosion tests for the absorber tubes themselves. Consequently, it proved difficult to develop a test sequence with which it is possible to examine the durability of absorber tubes and characterize the service life of a collector by means of a shortened test routine. Incidentally, the same also applies to solar heat transfer fluids. It is true there are laboratory tests to determine material compatibility based on corrosion rates; however, to date there are no representative and at the same time internationally standardized test procedures for collector circuits.

With headquarters in Rapperswil, Switzerland, SPF suggested a test scenario based on the assumption that as far as the solar heat transfer fluid is concerned, and as such the absorber tube itself, the stagnation condition is the critical application condition. It is for this reason that the test cycle brings an absorber and the fluid within it to the vapour phase and subsequently cools it down again in a controlled manner. The test sequence according to which diverse fluids have been successfully tested is contained in the "Test specifications SWW-2010-12". Based on an average of 30 stagnation conditions per annum, this results in a theoretical service life of 20 years.

Thus, this test confirms that aluminium tubes made from S-LIFE solar alloy last for more than 20 years and are, as a consequence, irrefutably suitable for use in solar systems.

Structure of a solar thermal system with S-LIFE® aluminium tubes

Aluminium possesses a natural protection against corrosion: an external, inert aluminium oxide film. Acids and salts can damage this film, so that it is possible for corrosion to occur. That is why it is important to avoid acidic compounds in conjunction with the choice of substances and production processes. Free oxygen in fluids can equally cause corrosion.

Aluminium tubes must only be used in closed systems (2-circuit systems). Fresh water must not be allowed to flow through them.

Aluminium tubes must be used only in systems in which corrosion-inhibiting substances (inhibitors) are added to the solar fluid, which is itself approved for the temperature range of the system. The manufacturer is obliged to confirm its suitability for aluminium (e.g. to ASTM D1384). In accordance with best practice, the manufacturer's specifications must be observed when filling; this applies in particular to the mixing ratio, preparation including flushing and subsequent venting. Concentrates must be diluted outside of the system in accordance with the manufacturer's specifications before being used to fill the system.

With regard to the terms and conditions of guarantee in particular it is imperative to adhere to specified service procedures and intervals!

The following products have been tested in accordance with the so-called SWW test standard, and are approved for use in S-Life Solar aluminium tubes (listed according to test date):

- TYFOCOR® L supplied by Tyforop (tested at SPF, Rapperswil in 2007 and at Standard-Metallwerke in 2008)
- UCOTHERM W-PGA supplied by Fragol (tested at Standard-Metallwerke in 2008)
- ZITREC L supplied by Fragol (tested at Standard-Metallwerke in 2008)
- ANTIFROGEN L supplied by Abderhalden Fluids AG (stagnation test 2008 at Soltop according to company test sequence and assessed at Standard-Metallwerke)
- Tap water supplied by department of public works Werl/Westfalen (tested at Standard-Metallwerke in 2009)
- PEKASolar 50 supplied by proKühlsole (tested at Standard-Metallwerke in 2011 & 2012)
- CORACON SOL 5F supplied by Aqua Concept (tested at Standard-Metallwerke in 2012)

Only solders suitable for aluminium should be used in conjunction with aluminium tubes (e.g.: AlSi-based solder). Under no circumstances should the solder contain any zinc, unless used in low concentrations as a bound additive. Furthermore, the manufacturer must declare it to be suitable for use with aluminium. It is advisable to use a non-corrosive flux that contains no chlorides for brazing. When using corrosive fluxes it is imperative to ensure

the brazed joint is thoroughly cleaned after brazing to prevent corrosion (companies with experience of brazing aluminium: Flux, Vermotek, Fontagen).

Commercially available connectors made of aluminium, stainless steel or brass may be used; however, it is fundamentally important to ensure their suitability for use in conjunction with solar collectors. Aluminium connectors, such as those supplied as of recently by SERTO and ALL-VALVE.IT facilitate same-metal connections, in particular when the connected supply lines are also made of aluminium. Iron and low-grade steel connectors are NOT permitted. Galvanized components are also forbidden. Fundamentally, the mix of materials in a solar thermal circuit should be kept as low as possible.

When preparing, do not allow filings or chips to enter the tubes that can become stuck because of their size. That applies in particular to copper and brass filings and chips. Generally speaking, non-cutting processes should be preferred.

Flush the system after assembly, and ensure the tubes are well and truly drained (please also refer to the specifications provided by the fluid manufacturer). Ensure any cleaning fluids used are suitable for aluminium. Analogous to fluid manufacturers' specifications it is not permitted to allow a system to stand empty for any length of time after it has been filled or flushed in order to avoid corrosion. That applies in particular to circuits comprising corrugated stainless-steel tubes, because possible traces of rust can reduce the performance of the fluid.

It is possible to use corrugated stainless-steel, aluminium and copper tubes for supply lines. It goes without saying that the pipes must be suitable for solar thermal circuits.

Guarantee

When all these specifications are met it is possible to guarantee a service life of between 15 and 20 years. For individual cases it is necessary to present details of the materials used and a schematic diagram of the system.

If you have any questions or require additional information, please contact:

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