Parabolic Trough Receiver Heat Loss Testing

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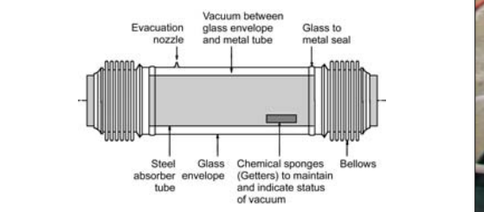
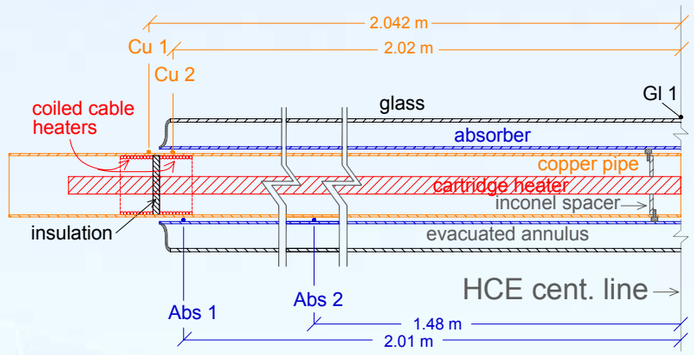
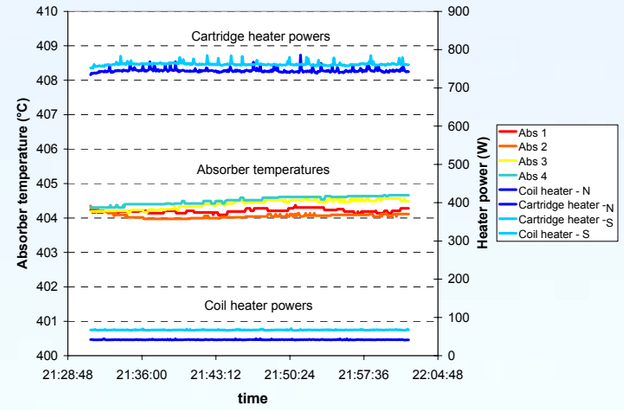


NREL Test Stand Schematic
North end



Thermocouple and heater locations - North end of test stand

Schott PTR70 steady-state heat loss at ≈ 400 °C (752 °F)

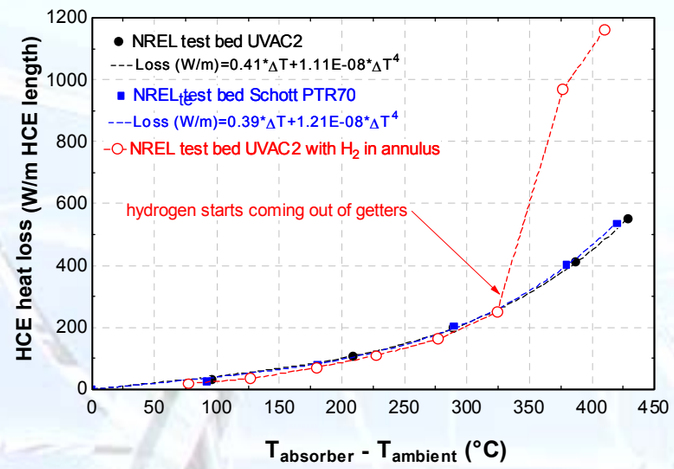


Reasons for testing

Parabolic trough receivers, or heat collection elements (HCEs), absorb sunlight focused by the mirrors and transfer that thermal energy to a fluid flowing within them. The absorbing tube of these receivers typically operates around 400 °C (752 °F). HCE manufacturers prevent thermal loss from the absorbing tube to the environment by using sputtered selective Cermet coatings on the absorber and by surrounding the absorber with a glass-enclosed evacuated annulus.

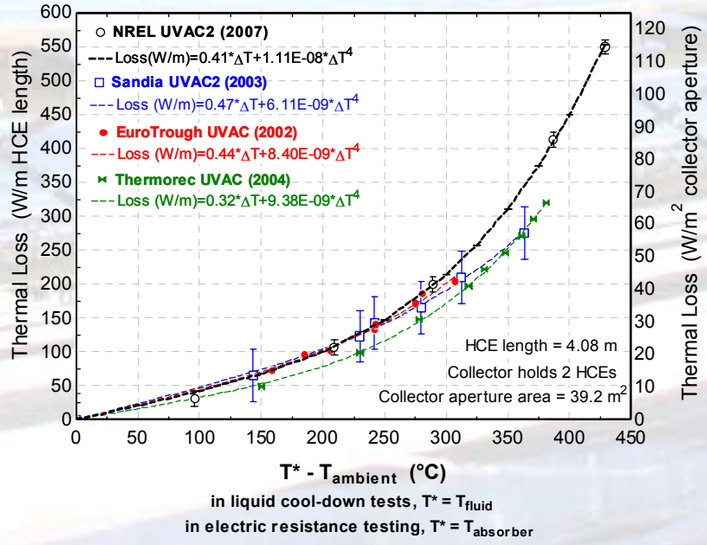
This work quantifies the heat loss of the Solel UVAC2 and Schott PTR70 HCEs. At 400 °C, the HCEs perform similarly, losing about 400 W/m of HCE length. To put this in perspective, the incident beam radiation on a 5 m mirror aperture is about 4500 W/m, with about 75% of that energy (≈3400 W/m) reaching the absorber surface. Of the 3400 W/m on the absorber, about 3000 W/m is absorbed into the working fluid while 400 W/m is lost to the environment. This is exceptional performance.

Results



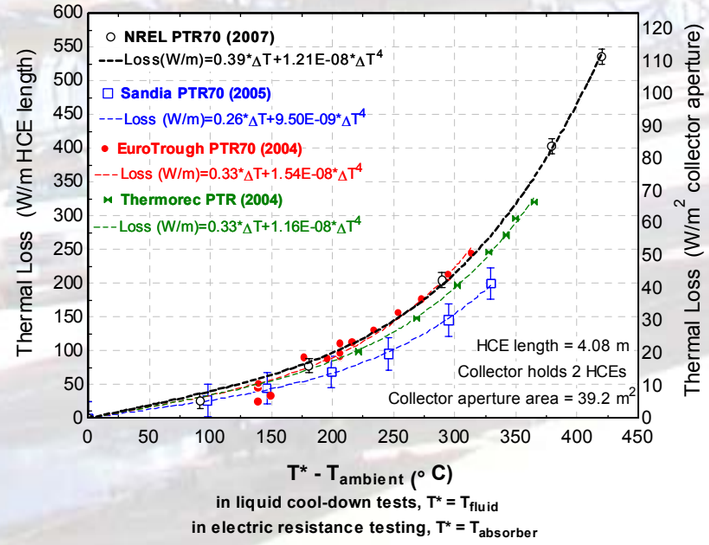
Comparison with other heat loss data

Solel UVAC2



in liquid cool-down tests, $T^* = T_{fluid}$
in electric resistance testing, $T^* = T_{absorber}$

Schott PTR70



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