COMMISSIONING OF THE ORCHID EXPERIMENTAL FACILITY

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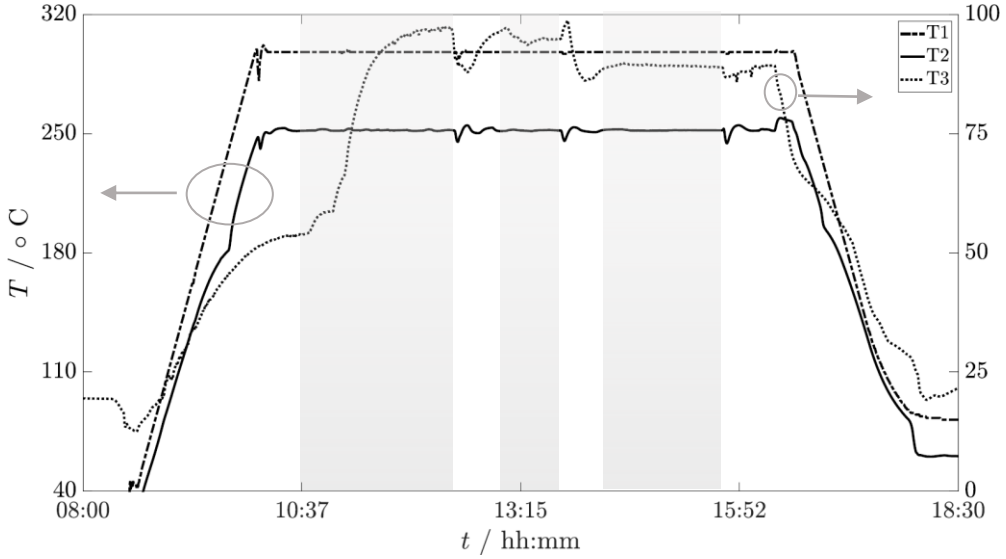
ABSTRACT

Organic Rankine Cycle (ORC) power systems are receiving increased recognition for the conversion of thermal energy into mechanical work or electricity down to power output of, say, 10 kW_e. Efficient expanders are the enabling components of such systems, and these machines get more challenging to design as their size decreases. Virtually no experimental gasdynamic data are available in the open literature concerning the fluids and flow conditions of interest for mini-ORC expanders, which hampers the validation of design methodologies and tools.

In order to bridge this gap, a new experimental facility capable of continuous operation was designed and built at Delft University of Technology, The Netherlands, starting in 2015. This is called Organic Rankine Cycle Hybrid Integrated Device (ORCHID), and its conceptual and preliminary design were presented in 2016[1].

This contribution aims at presenting to the ORC community the status of the ORCHID facility, whose commissioning was successfully concluded at the end of 2018.



Evolution of working fluid temperatures during a typical testing day. The working fluid is siloxane MM. T1 is the heat source maximum temperature, T2 and T3 (right y-axis) are the evaporation and condensation temperatures.

Some exemplary results of commissioning tests using siloxane MM as the working fluid are shown in the figure. The target evaporation temperature (T2) -252 ℃ in this case- is reached and kept stable within ± 1 ℃ for several hours (shaded regions). The larger variations are due to adjustments and checks performed for commissioning purposes.

[1] A.J. Head, C. De Servi, E. Casati, M. Pini and P. Colonna, 2016. *Preliminary design of the ORCHID: A facility for studying non-ideal compressible fluid dynamics and testing ORC expanders*. In Proceedings of the ASME Turbo Expo 2016, vol. 3. American Society of Mechanical Engineers (ASME).