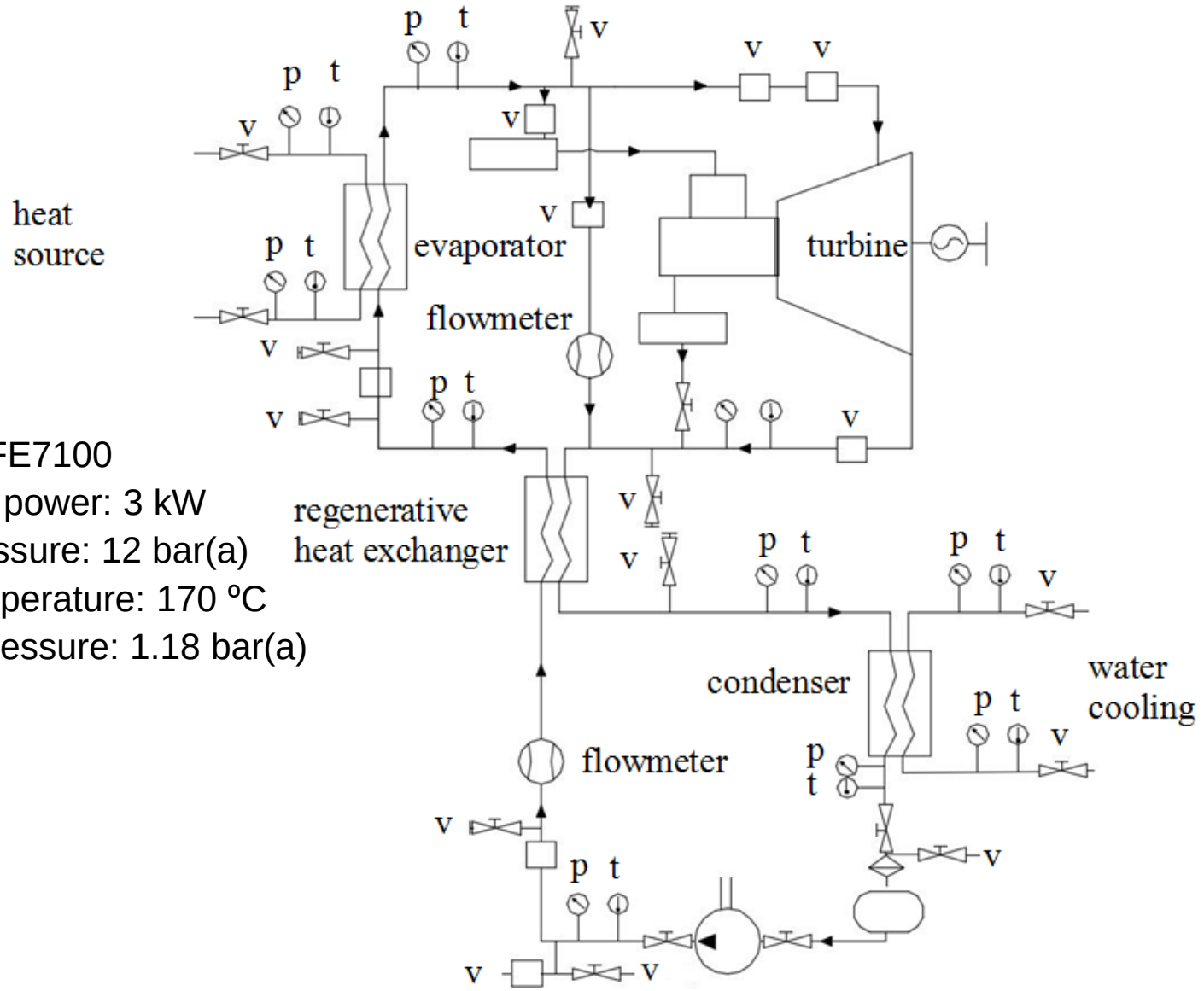
Start-up Research on The Laboratory Micro CHP ORC Test Stand

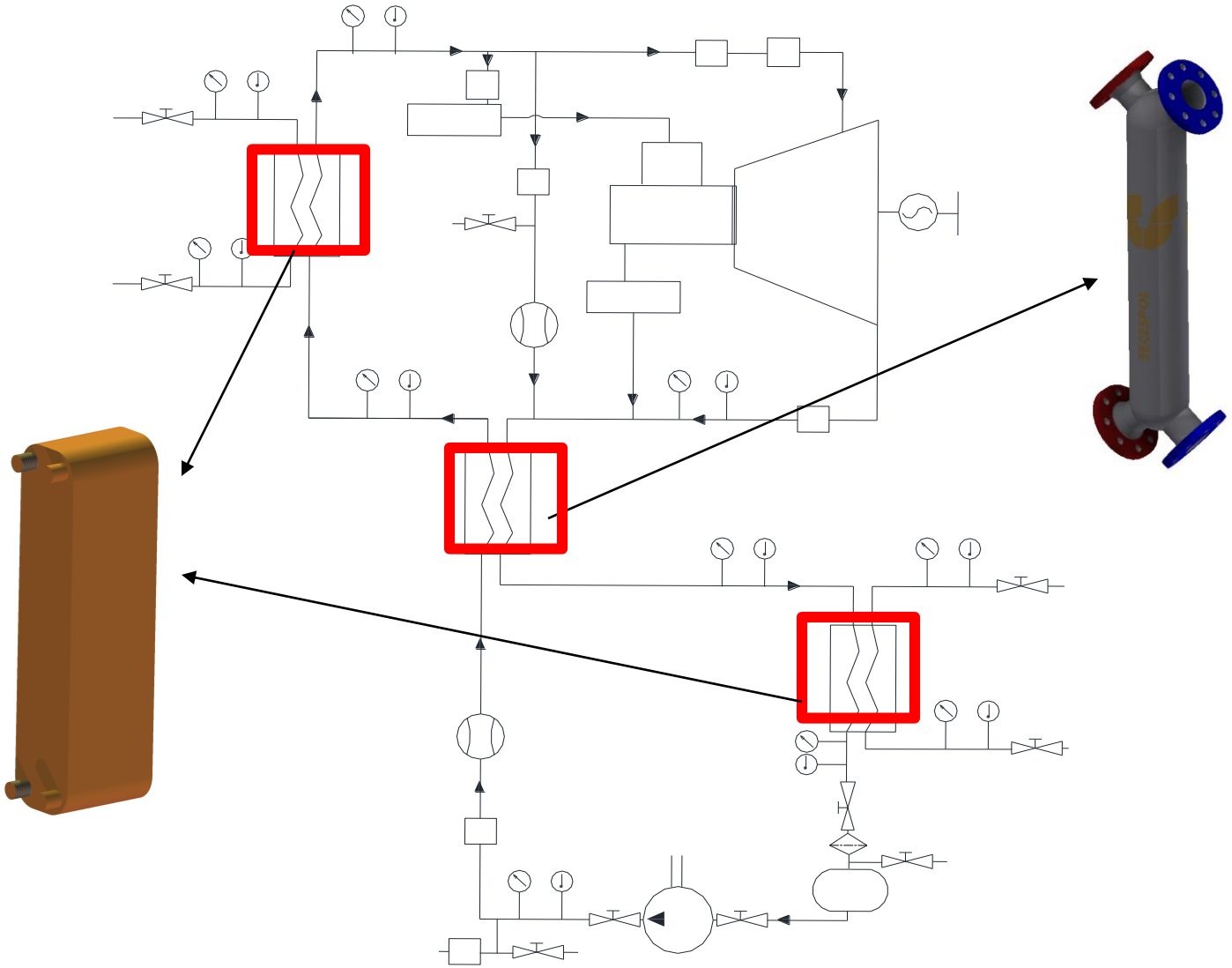
Sebastian Bykuć, Łukasz Breńkacz, Grzegorz Żywica, Piotr Klonowicz

System description

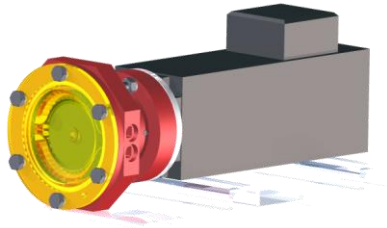


Features:
-Fluid: HFE7100
-Nominal power: 3 kW
-Inlet pressure: 12 bar(a)
-Inlet temperature: 170 ºC
-Outlet pressure: 1.18 bar(a)

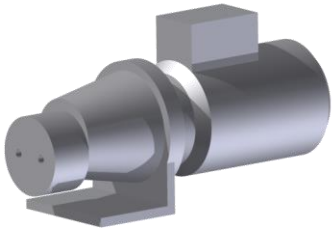
System description



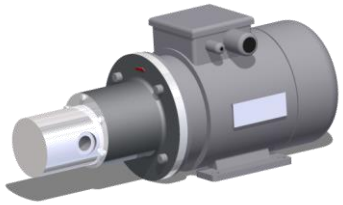
System description



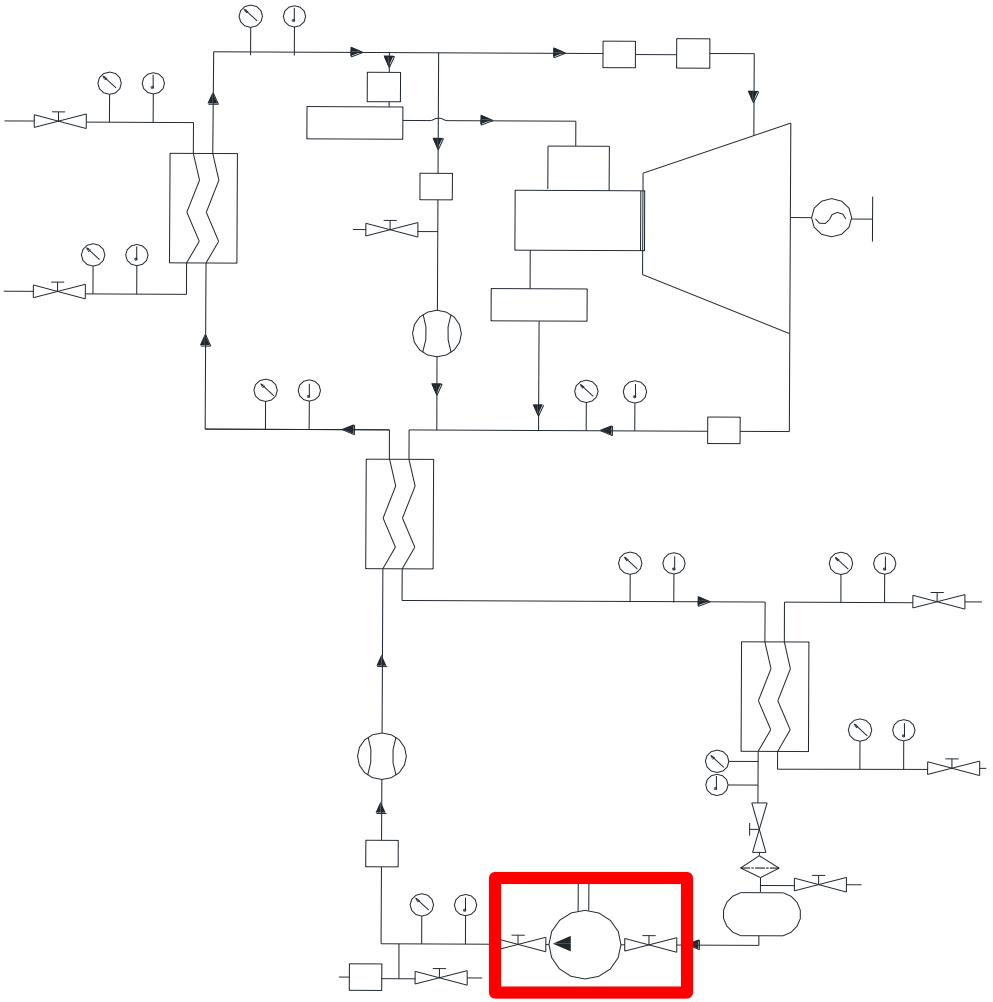
Prototype of peripheral pump



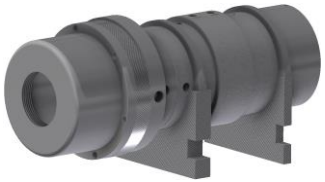
Gear pump



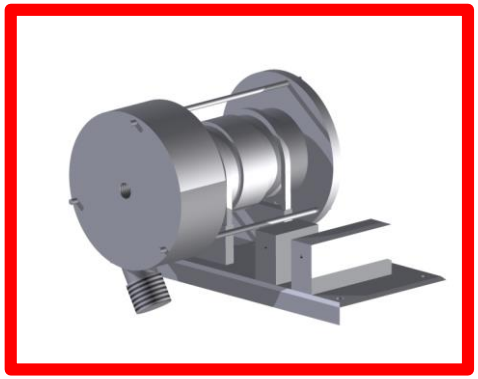
Gear pump



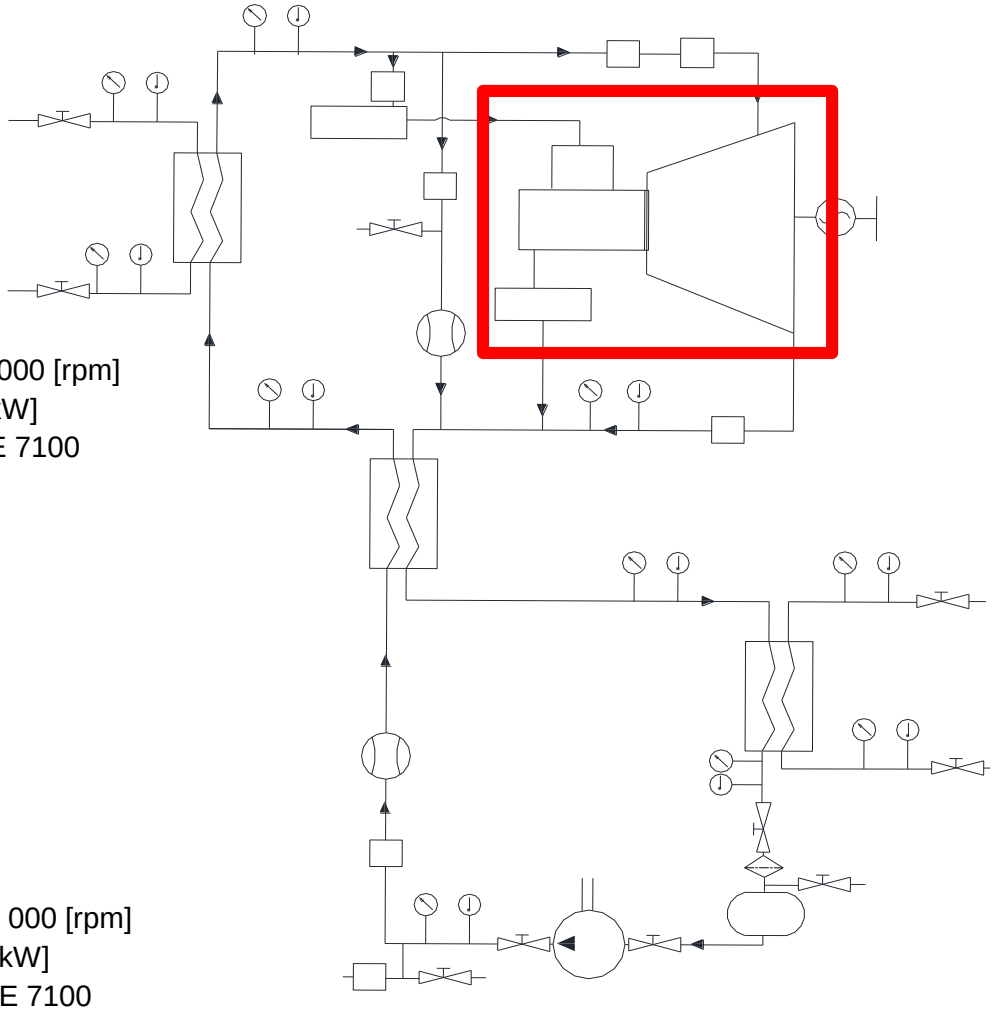
System description



Design paramters: Rotational speed: 24 000 [rpm]
Internal power: 3.00 [kW]
Working medium: HFE 7100

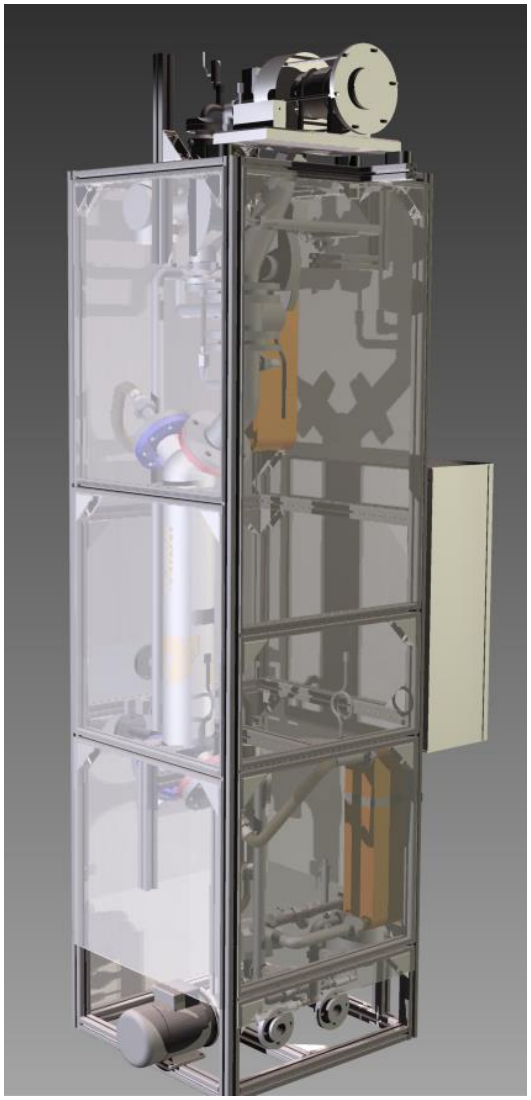


Design paramters: Rotational speed: 35 000 [rpm]
Internal power: 3.26 [kW]
Working medium: HFE 7100



Cooperation with Lodz University of Technology (prof. Z. Kozanecki Team)

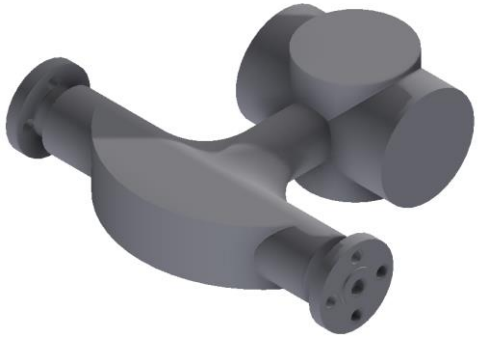
System description



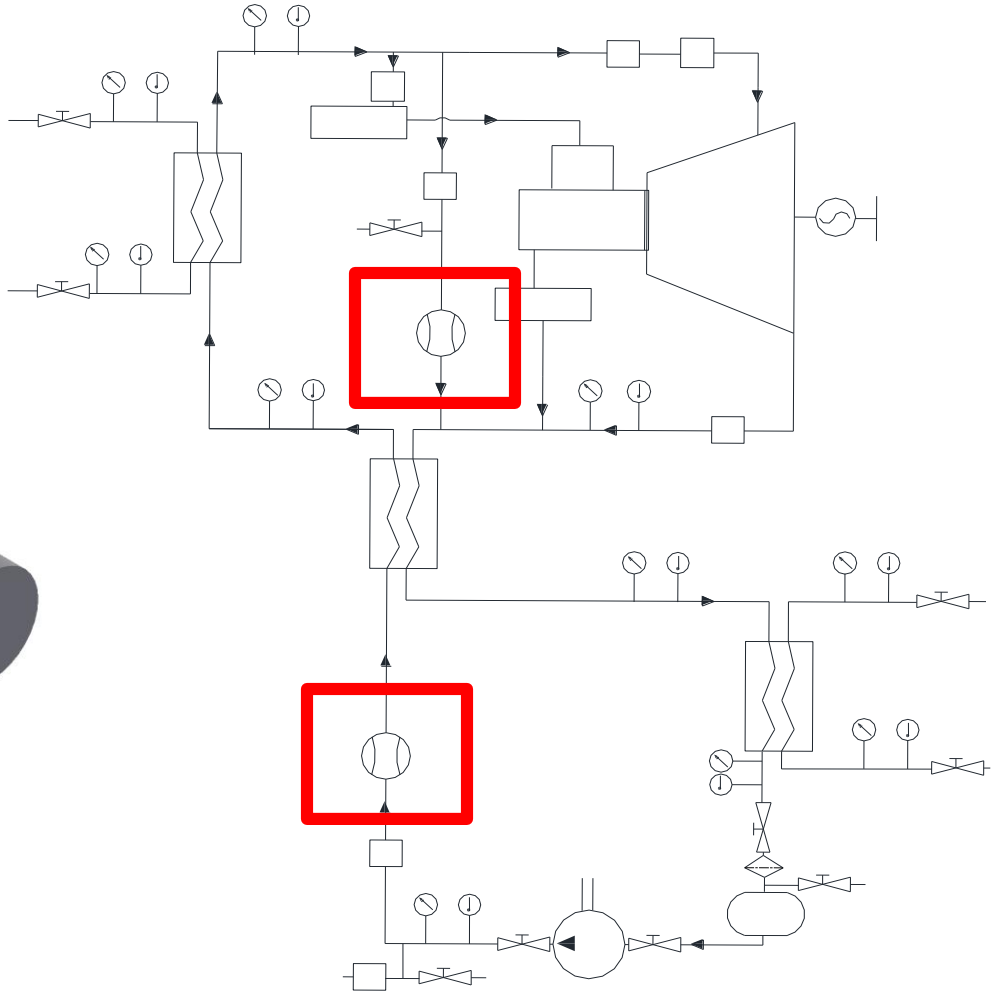
Model of the ORC power plant test stand

Real construction

System description

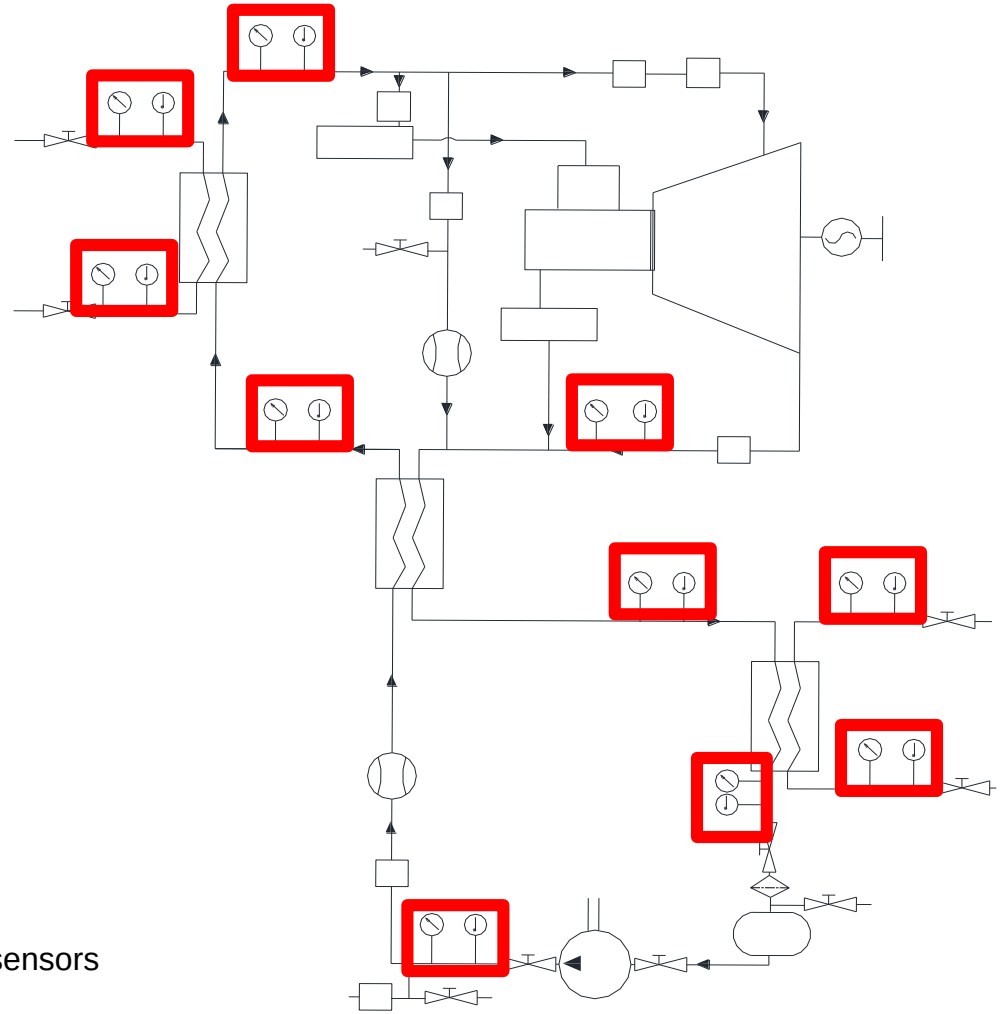


Flowmeter

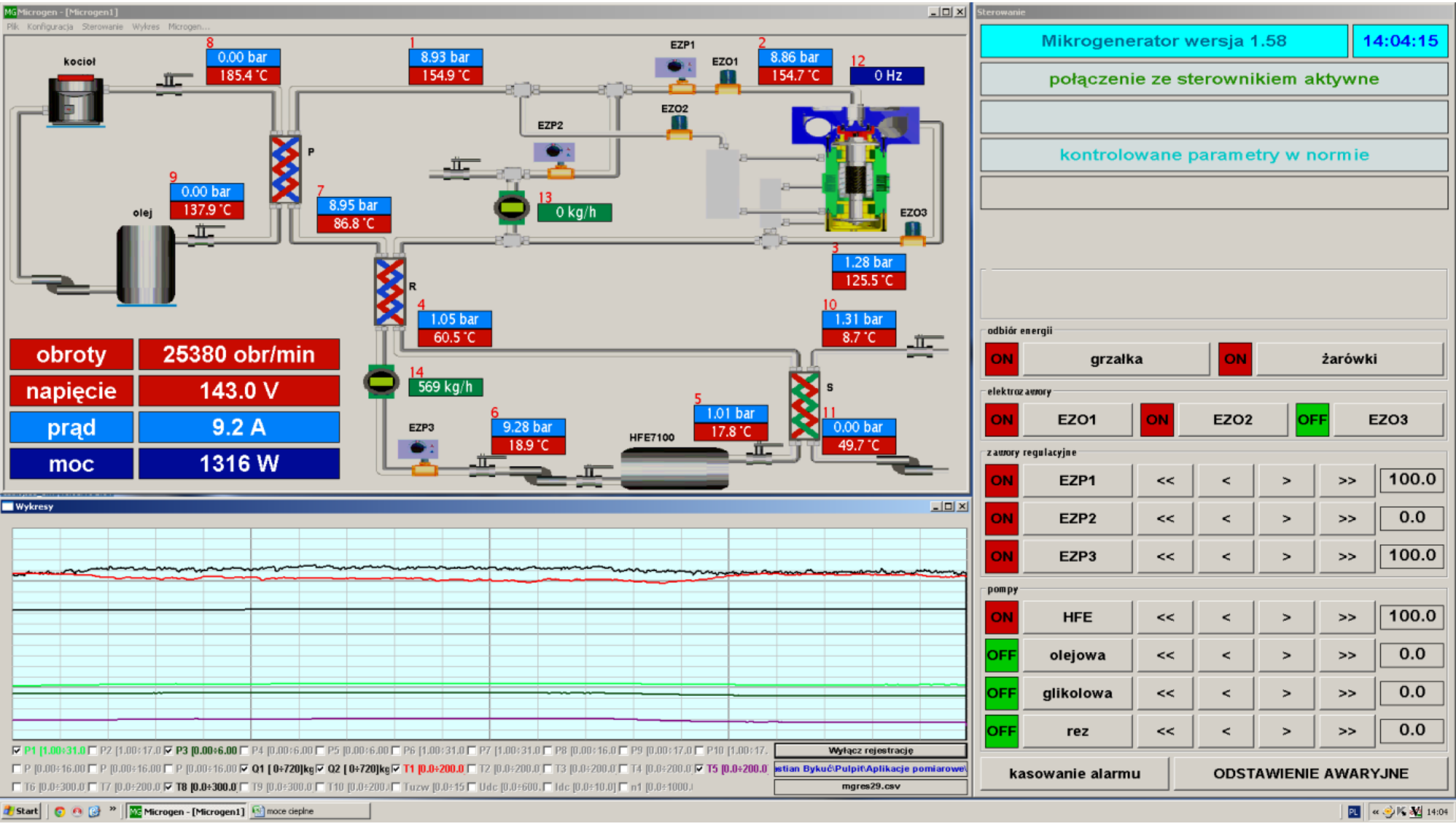


System description

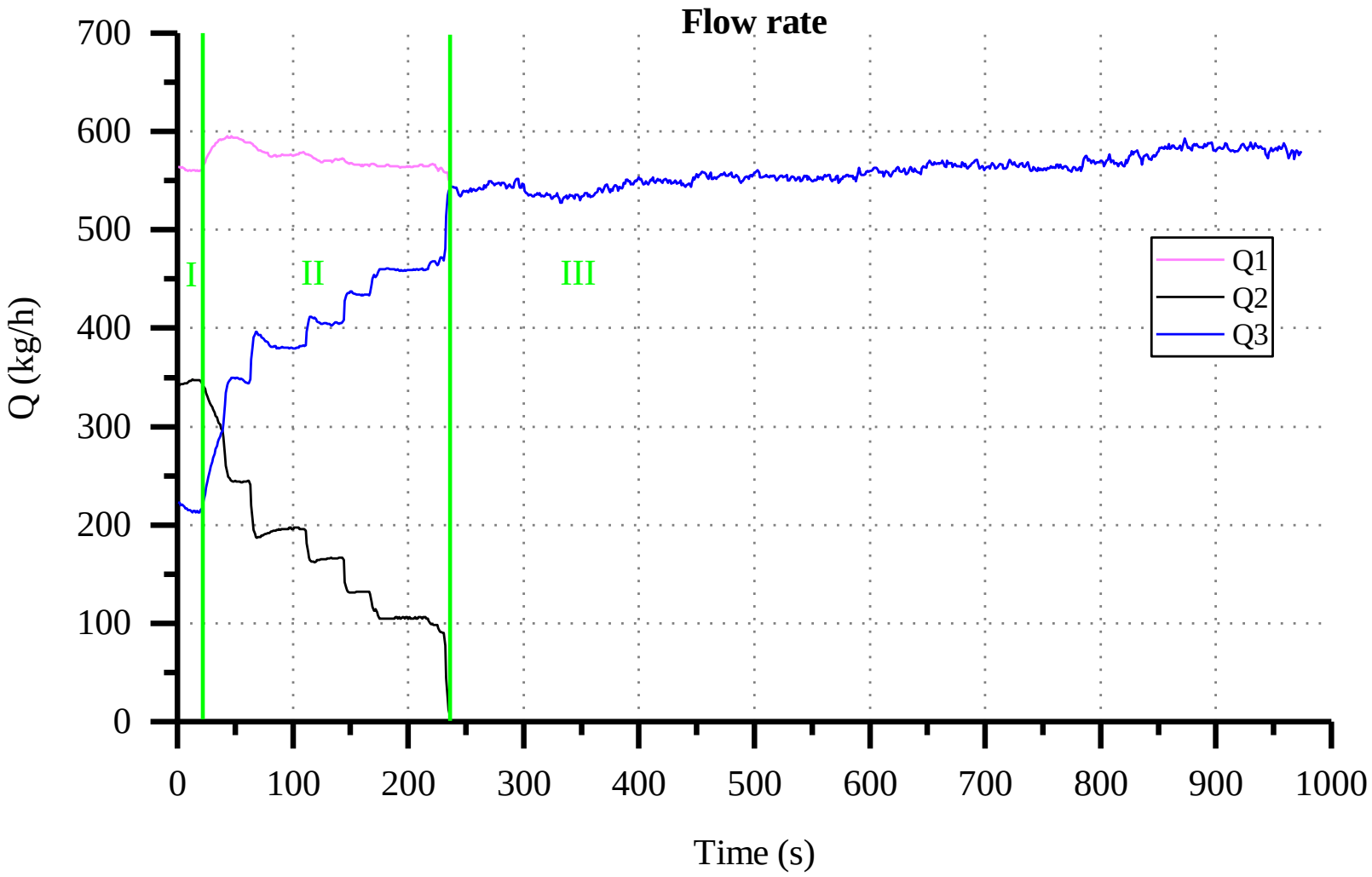
Temperature and pressure sensors



System description

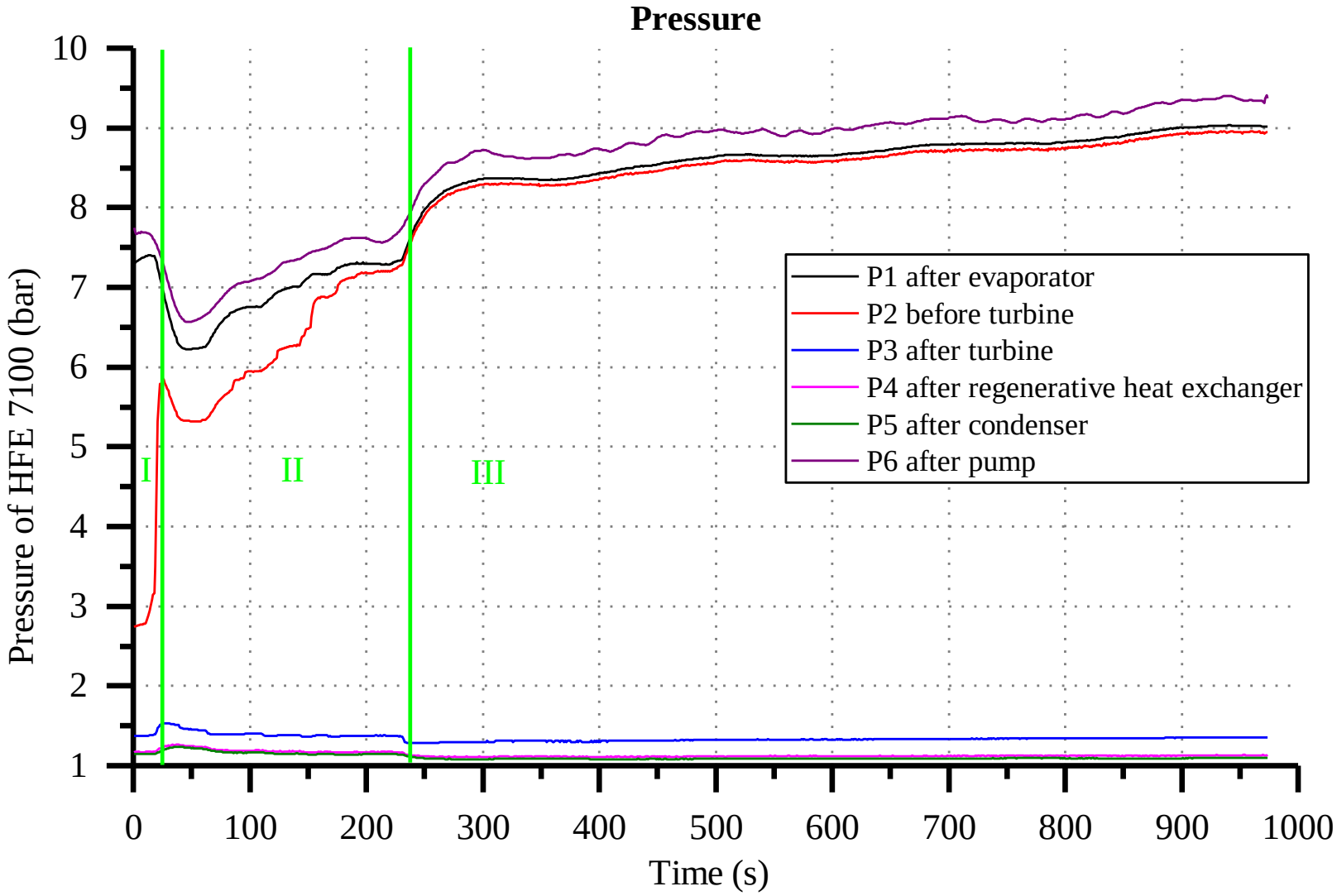


Results



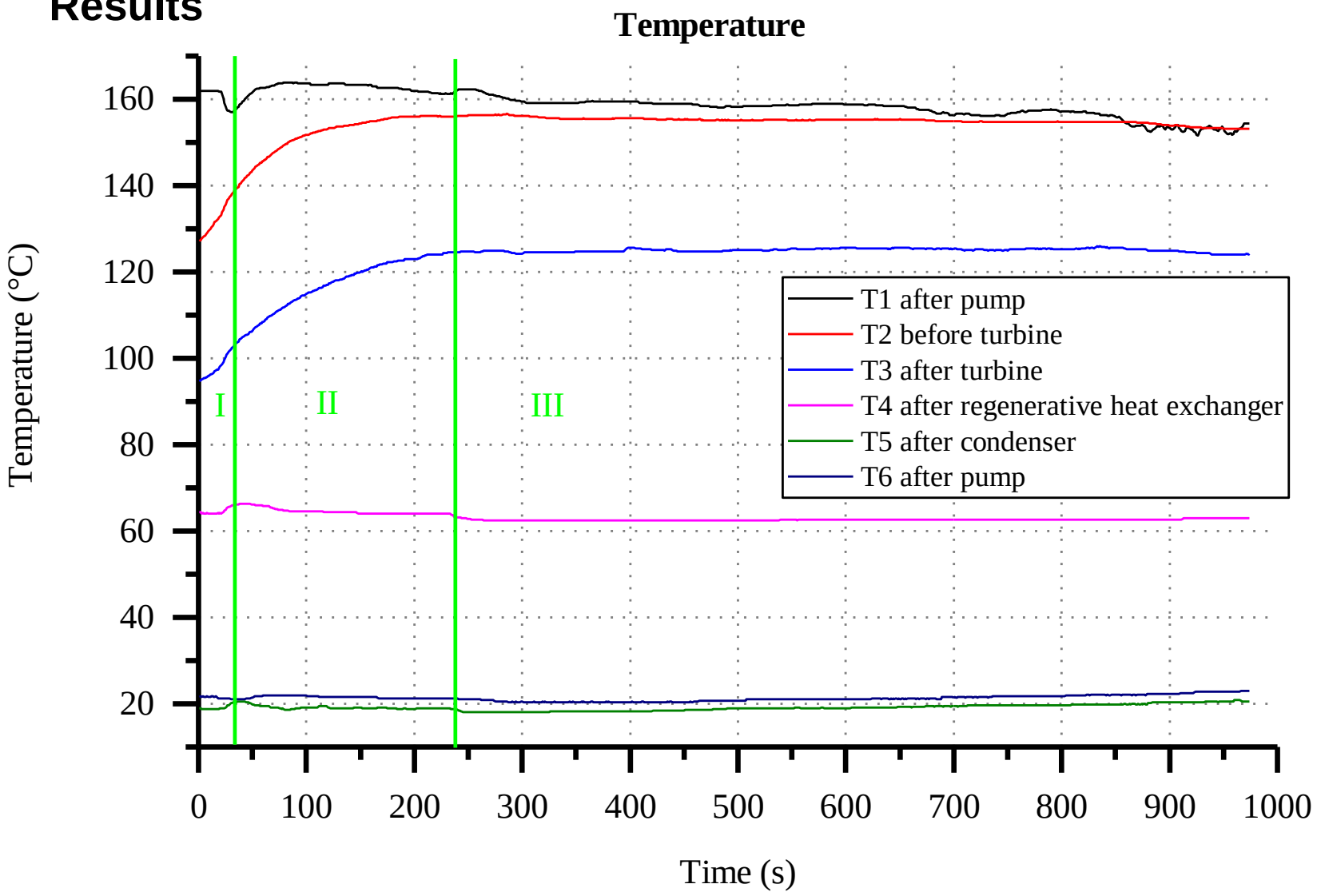
Mass flow rates (Q1- total flow rate, Q2-by-pass flow rate, Q3-turbine flow rate)

Results



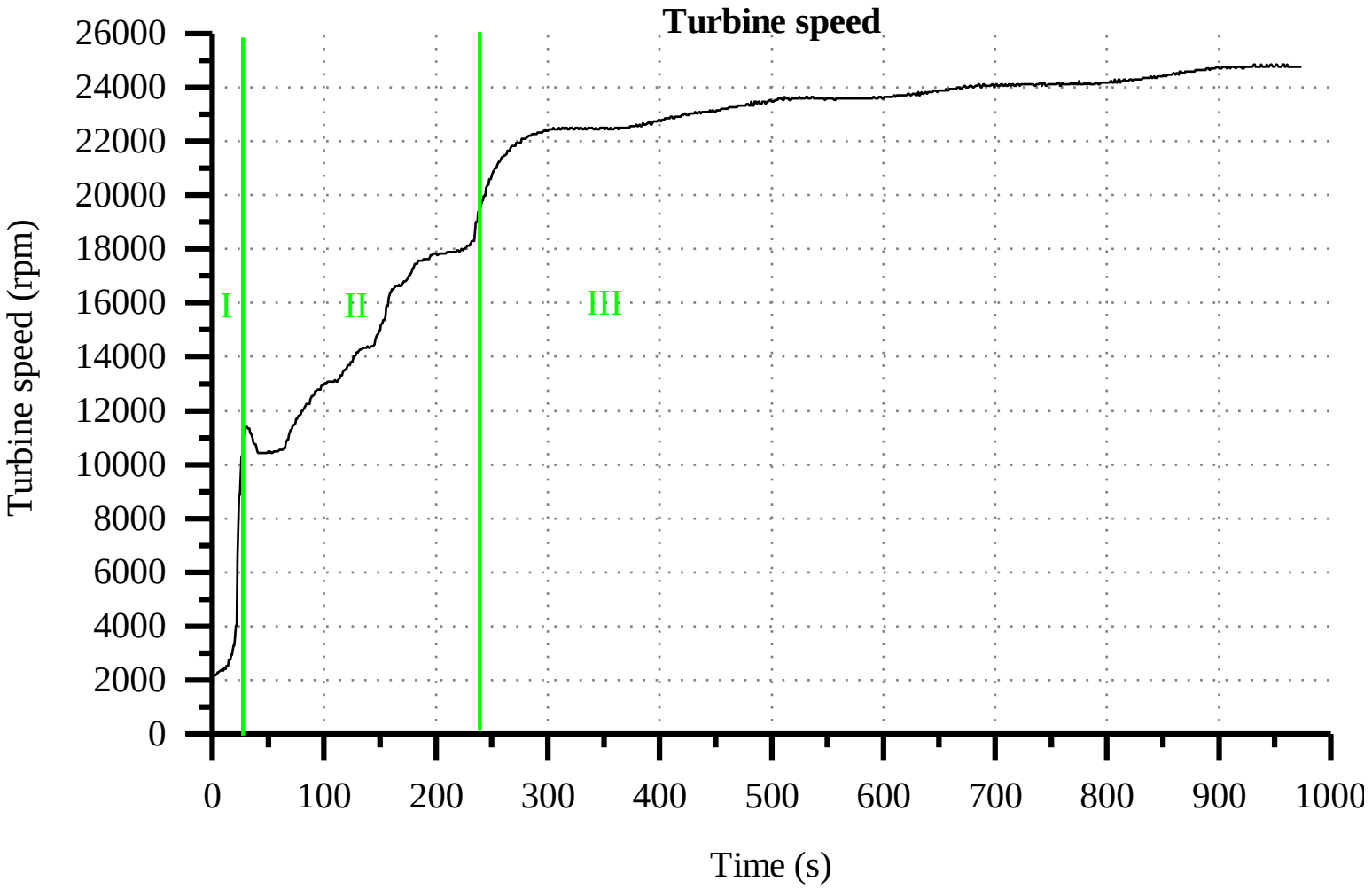
Pressure curves in the time domain obtained during startup

Results



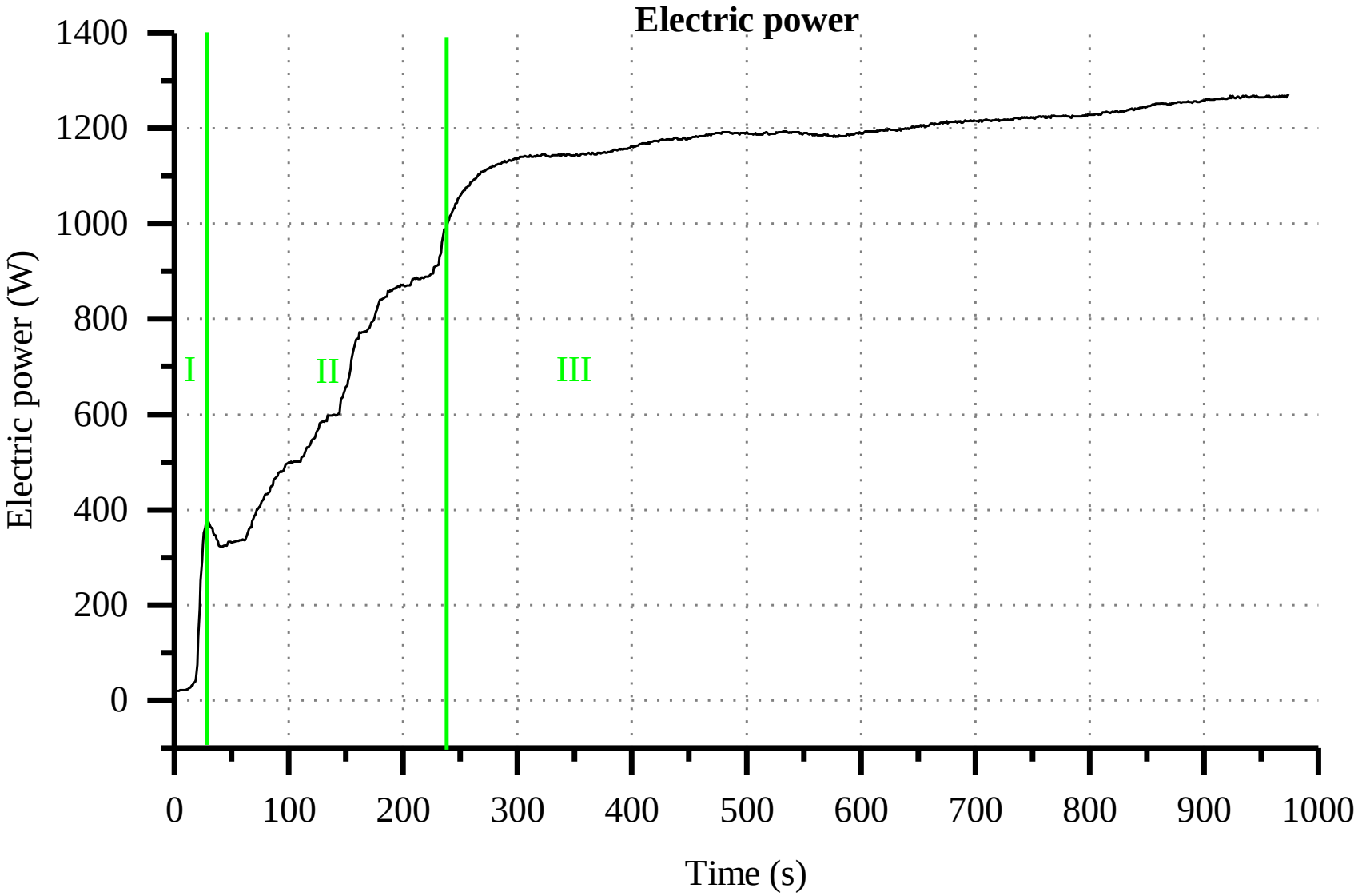
Temperature curves in the time domain obtained during startup

Results

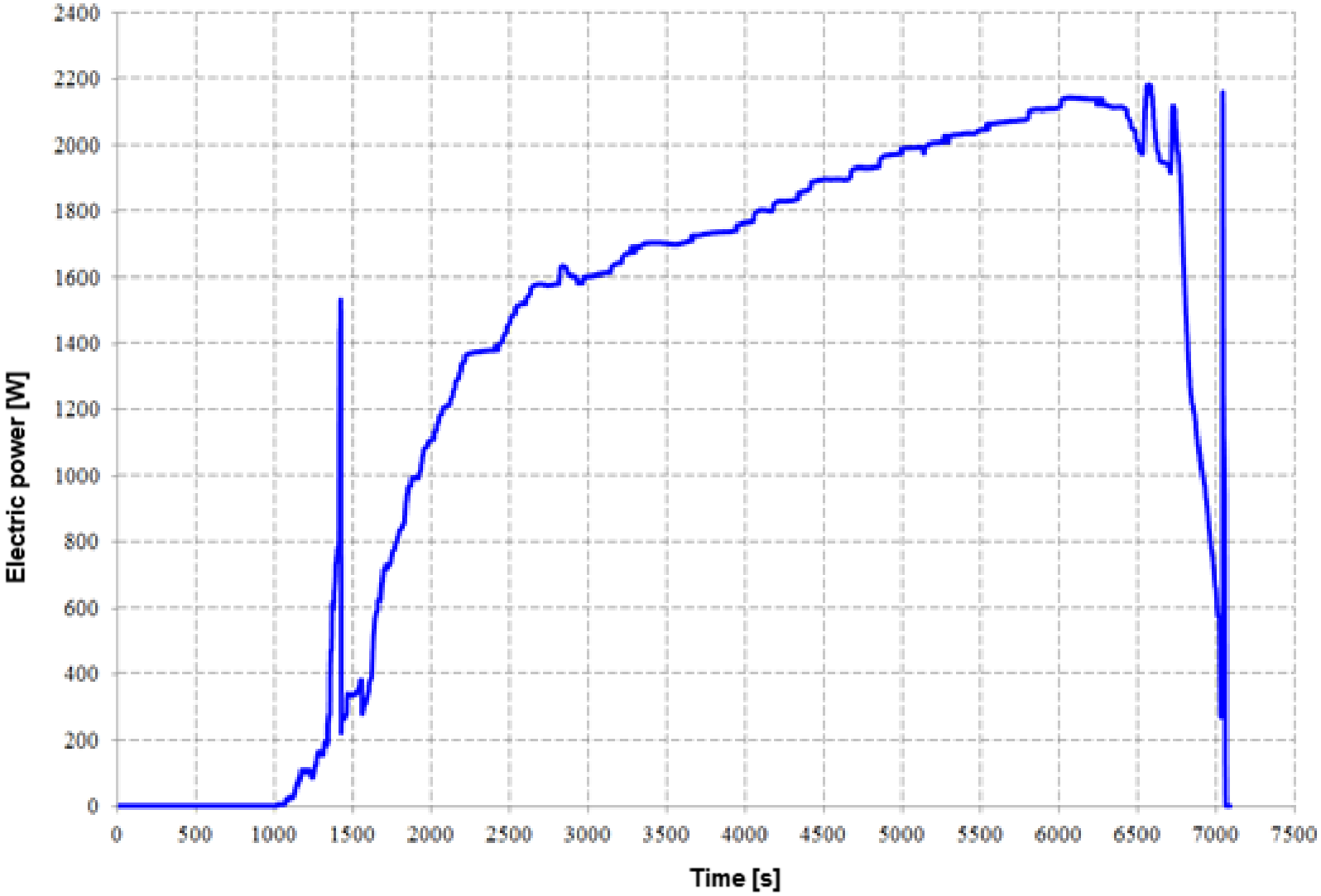


Rotational speed of turbogenerator in the time domain obtained during startup

Results



Power generated in the time domain obtained during startup



Electric power plots

Conclusions

-We have designed a fully functional micro CHP system with a hermetic microturbine based on a single, highly loaded stage.

-The microturbine is fully hermetic

-The gas bearings fully support the shaft even at low rotational speed, the turbine operation is very quiet

-The detaled measurements of the efficiencies should be performed

-"Real-life" conditions should be simulated and the system behavior should be examined

The research works presented in this presentation were financed by the project POIG.01.01.02-00-016/08 “Model agroenergy complexes as an example of distributed cogeneration based on local renewable energy sources”

Thank you for your attention

The laboratory test stand of the ORC micro power plant

Sebastian Bykuć, Łukasz Breńkacz, Grzegorz Żywica, Piotr Klonowicz