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WP3 - Deliverable D3.3–report 200 kW 2-PC concept design



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List of Acronyms and Abbreviations

Abbr.	Description
2-PC	Two-phase cooling
bara	unit for absolute pressure (1 bar = 100,000 Pa)
barg	unit for gauge pressure, which is the pressure relative to local ambient pressure
AM	Additive Manufacturing
FC	Fuel Cell
HX	Heat exchanger(s)
PGS	Power Generation System
TMS	Thermal Management System
PPS	Propulsion System
eglycol	Ethylene-glycol (40-60 % Water)
EGW	Ethylene glycol-water mixture
MPL	Mechanically pumped loop
MEA	Membrane Electrode Assembly
PFAS	Per- and polyfluoroalkyl substances
HCA	Heat controlled accumulator
PCA	Pressure controlled accumulator



1 Executive Public Summary

The objective of task 3.2 of WP 3 of the BRAVA project is to develop and demonstrate a 200 kW two-phase cooling (2-PC) system with a 20% lower mass than a conventional liquid cooling system and 50% lower pump power.

In this document, a 2-PC with a cooling capacity with 1926 kW was analysed. This analysis was used to select methanol as cooling fluid for the 200 kW 2-PC demonstrator. Using a non-flammable alternative results in a much higher system mass.

A cooling system with a liquid ethylene glycol-water mixture (EGW) has also been analysed. According to the simulations, the mass of a 2-PC with methanol and a conventional 'large' accumulator is 25% lower than the mass for a liquid EGW cooling system. This is slightly better than the BRAVA objective of 20% mass reduction. Once the 200 kW demonstrator has been built and tested in next phases of this project, the analysis for the 1926 kW system will be updated. For example, it will be tested if the 'no accumulator' or 'small accumulator' concept can be used, which could result in a large mass reduction of the 2-PC.

After the analysis, a concept design for a 200 kW 2-PC was made, and the main components are described.

Several test setup for risk mitigation have been built. For example at the start of the project, it was not clear if methanol is compatible with aluminium at a temperature around 95°C. For this reason, material compatibility tests have been carried out. Furthermore a pump test setup was built to mitigate the risk of pump issues with the 200 kW demonstrator.

Before the 200 kW is built, a 20 kW system has been built in order to test several concepts and control methods.

The concept design for the 200 kW 2-PC and the results of the risk mitigation tests that are described in this report will be used for the detail design phase of the project.

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Project partners:

#	Partner short name	Partner Full Name
1	A-D	AIRBUS OPERATIONS GMBH
2	A-E	AIRBUS OPERATIONS SL
3	AER	AEROSTACK GMBH
4	CNRS	CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE
4.1	UM	UNIVERSITE DE MONTPELLIER
5	HER	HERAEUS DEUTSCHLAND GMBH & CO KG
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