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Air Liquide cryogenic solutions for HTS refrigeration

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Air Liquide started the development of Turbo-Brayton cryogenic refrigerators in 2007. The goal was to design refrigerators with high efficiency and reliability, which are key issues when talking about HTS systems refrigeration. The innovation consists in the assembly of all active elements on the same shaft. The recovery of the expander mechanical power, the centrifugal compressors and the direct drive high speed motor lead to a high overall efficiency. The operation is very flexible, and the cold power can be adapted from 0 to 100% by changing the rotation speed of the motor, keeping high efficiency on a large range of operation.
A standard range of industrial Turbo-Brayton refrigerators (5-23kW at 77K) is now available. A first industrial refrigerator has been manufactured and tested in-house in 2012, and a second has been commissioned end of 2013, demonstrating the reliability of the refrigerators. The developments continue, in order to increase the cold power up to 40kW.
The use of cryogenic pumps is necessary to transfer the heat from the refrigerator to the HTS device to be cooled. Air Liquide has developed a range of cryogenic circulators on active magnetic bearings in order to ensure a Mean Time Before Failure of 105 000 hours of the global system (refrigerator + pump).

Primary author: GONDRAND, Cecile (A)

Co-authors: Mr DURAND, Fabien (Air Liquide Advanced Technologies); Dr DELCAYRE, Franck (Air Liquide Advanced Technologies); Mr BRUNET MANQUAT, Loic (Air Liquide Advanced Technologies); Mr STAEMPFLIN, Martin (Air Liquide Advanced Technologies)

Presenter: GONDRAND, Cecile (A)

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