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C2Po2B-09: Design and construction of 1,300 L zero-boil off (ZBO) liquid hydrogen storage tank

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A 1,300 liter-capacity liquid hydrogen (LH₂) storage tank has been designed and constructed. The thermal insulation system of the LH₂ storage tank is designed to have a boil-off rate (BOR) of 1.5 vol.%/day and a refrigeration system is introduced to achieve zero-boil off (ZBO) of LH₂. A multi-stage GM-type pulse tube refrigerator (PT815, Cryomech) is utilized for the refrigeration system. The LH₂ storage tank is mainly composed of a radiation shield and an internal reservoir. The aluminum shield is conductively cooled by the first stage of the pulse tube cryocooler and it also equips a vapor-cooled loop for rapid initial cooling. The stainless-steel reservoir has a fin-array to suppress pressure elevation due to the vaporized hydrogen at its top side. The fin-array is cooled by the second stage of the pulse-tube cryocooler and it is made of oxygen-free high conductivity (OFHC) cooper. The fin-array is brazed with the reservoir body and it is designed to have a proper thermal resistance between them. The annular space between the outer shell and the internal reservoir is evacuated down to 10⁻⁵ mbar.

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