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C3Or3B-05: Effects of throttle and heater input for reducing pressure surging in a liquid hydrogen tank pressurizer

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Extracting liquid from hydrogen storage vessels require the maintenance of pressure in the ullage space to ensure uniform flow to a consumer. Due to the large change in volume during vaporization of liquid hydrogen, a percentage of flow is diverted from the consumer for pressure maintenance back into the tank. The return state of the hydrogen should be close to saturated vapor at comparable volumetric flow rates for liquid extraction and smooth operation. This paper details the theory, design, and experimental performance of a liquid hydrogen pressurization system. A cartridge heater, throttle, and manual valve are utilized to vaporize, reduce pressure and pressure oscillations, and control flow. Experimental measurements are compared with theoretical predictions for liquid nitrogen and liquid hydrogen flows. The end results demonstrate the performance of the heater and throttle for pressure maintenance of a liquid hydrogen tank.

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