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EFFICIENCY OF HIGH-TEMPERATURE GENERATOR PRESSURIZATION SYSTEMS OF LIQUID METHANE LV TANKS

Abstract

Liquid methane is the most promising fuel for future launch vehicles (LV). The lower cost of it compared to kerosene, the increased calorific value and the advantages of its use in liquid propulsion system (LPS) will reduce the cost of LV that traditionally use liquid oxygen and kerosene. However, there are few researches about optimization of liquid methane supply systems, and they do not consider the apply of combustion products as pressurant of its tanks. In modern rocket developing, similar pressurization systems (PS) have proven themselves to be simple in design, reliable, and with minimal mass. Considered types of PS, such a gas-bottle (helium) or methane vaporizing have a significant drawback – the complexity of experimental testing, which must be carried out as part of the stage with LPS. In case of gas-bottle PS, up to 20 percent of helium mass remains in PS bottles at LPS shutdown time, and system's weight grows rapidly in proportion to the methane tank volume. Using generator PS allows to avoid of these problems. This keynote focuses on determining the effective application zone for generator PS of tanks with liquid methane, from the condition of minimizing the system mass. By using the developed and proven calculating method, the parameters of generator, gas-balloon and methane vaporizing PS for methane tanks are determined and generalized. As a result of the study, the high efficiency of high-temperature generator PS is shown, which allows to reduce the system mass up to 25 percent.