STATIC STRENGTH ANALYSES OF THE STEEL STRUCTURE OF BIOMASS RESERVOIR UNDER HYDROSTATIC PRESSURE

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Abstract

Subject of this paper is numerical analysis of the steel structure of biomass reservoir under hydrostatic pressure as well as additional loads. Reservoir was made from steel grade S235 and presents disassembly construction which contains eight walls of height of 5.5 meters placed on the floor in diameter of 10 meters. The floor is supported on eight legs along the scope and on the four center legs. Static strength analysis was performed by finite element method using 3D model obtained by the producer. Three load cases were analysed: a) hydrostatic pressure obtained by water to the height of 5 meters, b) hydrostatic pressure and snow force on the upper flange of 5.9 kN and c) hydrostatic pressure and biogas pressure on under flange of 8 mbar. Numerical results showed that the structure is not correctly defined. Maximal values of stresses are much higher than allowed for the steel S235, especially in the floor construction and on the joins between the walls and the floor. Reconstruction of the reservoir was suggested. The floor is reinforced by the under frame made from tubes of rectangle cross section and with additional supports in the central zone. These modifications gave lower values of the stresses. However, for use of full capacity of reservoir is necessary to increase thickness of steel cover of the floor and the walls on the height of 1 meter from the floor. Without any changes of the steel construction, producer decided to use reservoir with capacity of 1/5 of full (1m height of water) and moved prototype to farm where assembly of them started.

Keywords

Biomass, Finite Element Method, Hydrostatic Pressure, Static Strength Analysis, Biogas

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