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SPECIFICITY OF DESIGNING BRACKET FOR CONSTRUCTION OF VARIABLE WEIGHT

The standard method for calculating the bracket [1] is based on the theory of determining the loads acting on it. According to this methods, the eye of the bracket and its attachment to the structure (most often a shear bolt connection) is a critical place. The disadvantage of this technique is the determination of design parameters for only one fixed load value.

A special case of using the bracket is the installation of a supply tank for dosing systems of various types. Currently, the classical configuration of the dosing devices does not provide for the possibility of changing the hopper for various operating options. Fixing is carried out due to the rigid welded structure.

In this work, we consider the possibility of designing a bracket for a variable mass design. The need for such a design is associated with the operating time of the device without refueling the tank. The volume of the tank can vary for substances of different densities and volumes of one given dose. Therefore, the problem arises of studying the behavior of the bracket with such types of loading.

In the course of work in the SOLIDWORKS system, a three-dimensional model of the bracket holding the supply tank was built. The bracket is made of AISI 321. All calculations were carried out in the SOLIDWORKS Simulation system. The inlet calculations bracket was loaded with a working weight of 26 MPa.

As a result of the calculation, it was found that a minimum safety factor of 9.2 takes place on the surface of the application of force (Figure 1). A large margin of safety indicates that in this place the material is durable, withstands the initial load and can be saved. This simulation also showed that in addition to the eye, the weak point of the structure is the bend at the junction of the main zone with the attachment zone.

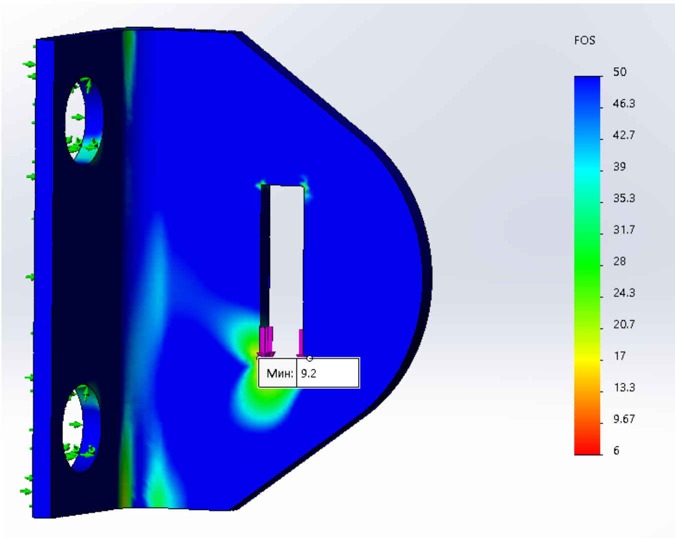

Figure 1. Safety factor in the presence of a design load of 26 MPa

As the possibility of installing a larger tank is considered, it becomes necessary to determine the maximum possible weight that the bracket can support. In a first approximation, a restriction is introduced – the yield strength. For the selected bracket material, it is 240 MPa [2].

Further research was carried out under a load of 233 MPa. Calculations showed that for given parameters, the minimum safety factor is 1.01 (Figure 2).

This means that the stress is close to the critical point of yield strength. With the resulting margin of safety, the structure loses its bearing capacity and the material is completely destroyed.

Accordingly, the maximum should be less than previously selected. Take a load of 198 MPa and conduct a similar study (Figure 3).

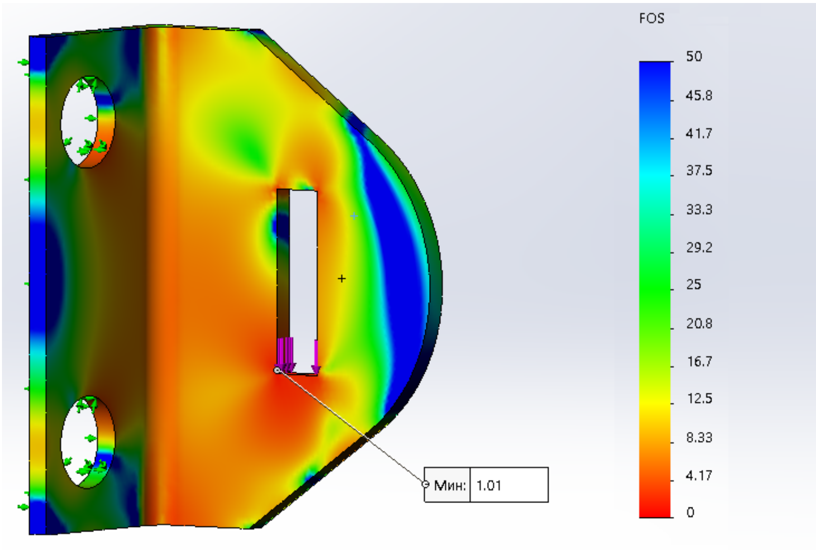

Figure 2. Safety factor at maximum load 233 MPa

The bracket is working, therefore, a load reduction of 17.5% of the yield strength ensures the operability of the structure.

The proposed work allowed us to move away from the traditional calculations of the bracket for a given mass and to study its behavior when the mass of the supply tank changes, which greatly facilitates the production of fixing structures.

Studies have shown that the design of the bracket requires additional calculation for the shear at the junction of the main zone with the fastening zone, and it is also necessary to take into account the loss of stability in the lower zone (zone III, Figure 3).

The maximum possible load on the bracket can be determined by redistributing the fluidity of the material by reducing it by 17.5%.

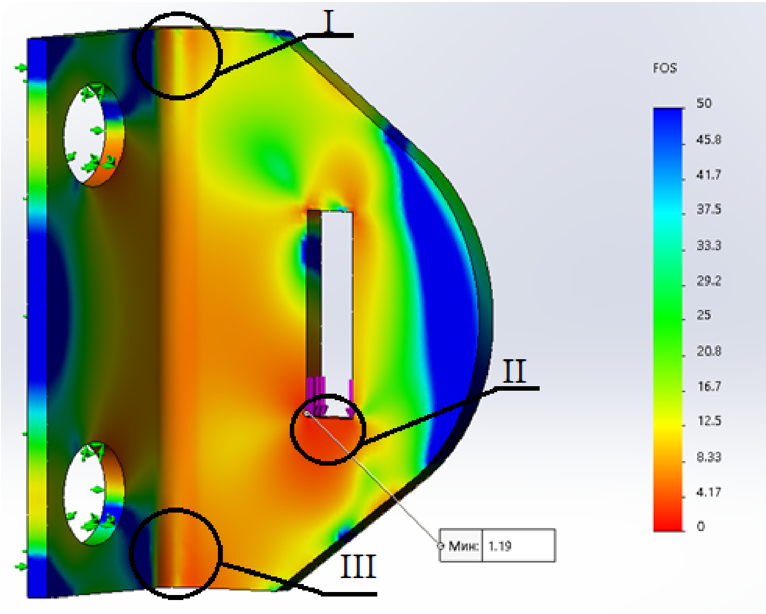

Figure 3. Safety factor at a load of 198 MPa

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