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METHODOLOGY FOR CALCULATING JET WASHING EQUIPMENT

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Technological equipment for washing and cleaning operations is important in the system of equipment repair. The choice of the type of washing and cleaning equipment depends on the size, material of the objects to be cleaned, the type of contamination, cleaning agents, as well as the requirements for the quality of cleaning.

The working process of jet washing equipment is based on the hydrodynamic and physicochemical effect of the jet of washing solution on contaminants, resulting in their partial dissolution and detachment from the surface being cleaned [1].

Dead-end low-pressure jet washers consist of a frame with an electric motor and pump mounted on it, pipelines, a washing chamber with a system of distributors, and a bath for the washing solution. The repair objects (parts, assemblies) to be cleaned are placed on a mesh trolley, which is then moved to the washing chamber. Inside the washing chamber there are frames consisting of pipes with distributors. Each distributor has nozzles through which the cleaning solution is supplied under pressure from above and from the side.

To select an electric motor for a pump, it is necessary to know the type of pump, the speed of its rotor, and the rated power of the electric motor. The rated power of the electric motor N_P, kW, is determined by the formula [2]

$$N_P = \frac{\rho \times g \times Q \times H}{\eta_H \times \eta_П \times 1000}, \quad (1)$$

where ρ − density of washing solution, kg/m^3;

g – acceleration of free fall, m/s^2;

Q – total fluid consumption, m^3/s;

H − liquid pressure at the pump outlet, m;

η_H, $\eta_П$ − efficiency coefficients of the pump and the drive, respectively.

The total fluid consumption Q depends on the fluid consumption when flowing out of the nozzle and the number of nozzles.

The hydrodynamic pressure of the fluid at the pump outlet H, m, is determined by the formula

$$H = H_{ГЕОМ} + H_H + \sum h, \quad (2)$$

where $H_{ГЕОМ}$ – geometric height of the liquid lift, according to the washing system drawing, m;

H_H – liquid pressure in the nozzle, m; $\sum h$ – sum of pressure losses, m.

Pressure H_H can be determined from the Bernoulli equation by the velocity coefficient, which depends on the shape of the hole and the type of nozzle, and the speed of fluid flowing out of the nozzle.

The total head loss is affected by the total coefficient of local resistances, the coefficient of resistance along the entire length of the pipeline, the length and diameter of the pipes.

Based on the calculated pressure and liquid consumption for supplying the washing solution to the chamber, a centrifugal console pump is selected according to the graphs. Considering that the nominal power should be $N_{НОМ} \geq N_P$, an electric motor is selected.

References

1. Дашивець Г. І. Обґрунтування способів, прийомів і обладнання для очищення агрегатів в умовах ремонтних підприємств // Праці Таврійського державного агротехнологічного університету. Вип. 9. Мелітополь : ТДАТУ, 2009.

2. Мандрус В. І. Гідравлічні та аеродинамічні машини (насоси, вентилятори, газодуви, компресори) : Львів : «Магнолія 2006», 2018. 340 р.

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