

УДК 621.355.29

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TRACTION BATTERY CHOICE METHOD

Electrical energy plays an important role in our daily life. It can universally be applied and easily be converted into light, heat or mechanical energy. A general problem, however, is that the electrical energy can hardly be stored. Capacitors

allow its direct storage, but the quantities are small, compared to the demand of most applications. In general, the storage of electrical energy requires its conversion into another form of energy. In batteries the energy of chemical compounds acts as storage medium, and during discharge, a chemical process occurs that generates energy which can be drawn from the battery in form of an electric current at a certain voltage.[1]

The alternative of the internal combustion (IC) engine is battery-powered traction. It is a modern trend due to economic reason and its environment effect.

Lead-acid, this more than 150-year-old system, is currently the reliable and economic power source for electric traction. The main application of lead-acid battery is vehicles for material handling, such as forklifts, stackers, pallet trucks, and so on.

The research aim is to choose optimal capacity of traction battery of the forklift.

Electric forklift with capacity 1t is driven by an electric motor with next parameter: voltage is 48V; current is 190A; power is 8,2 kW.

The forklift is relocated between loading points at least 10 times.

Total time of reposition under load is:

$$t_l = \frac{l}{v_l} \cdot R = \frac{50}{1,38} \cdot 10 = 362,319 \text{ s}, \quad (1)$$

where, l – is the distance between loading points; v_l – is the speed of forklift under load; R – is number of repositioning.

Total time of reposition without load is:

$$t_w = \frac{l}{v_w} \cdot R = \frac{50}{1,9} \cdot 10 = 263,158 \text{ s}, \quad (2)$$

where, v_w – is the speed of forklift without load.

The traction battery consumption of underload moving is:

$$Q_{lm} = I_m \cdot \frac{t_l}{3600} = 190 \cdot \frac{362,319}{3600} = 19,122 \text{ Ah}, \quad (3)$$

where, I_m – is the rated current of traction motor.

The traction battery consumption without load is:

$$Q_{vm} = I_m \cdot \frac{t_w}{3600} = 190 \cdot \frac{263,158}{3600} = 13,889 \text{ Ah} \quad (4)$$

The traction battery consumption for lifting is:

$$Q_{ll} = I_m \cdot \frac{q \cdot \frac{l_m}{v_{ll}} + q \cdot \frac{l_m}{v_{dl}}}{3600} = 190 \cdot \frac{10 \cdot \frac{3}{0.37} + 10 \cdot \frac{3}{0.54}}{3600} = 7,211 \text{ Ah} \quad (5)$$

where, q – is the number of lifting, up and down; l_m – is the mast height; v_{ll} – is the speed of lifting under load; v_{dl} – is the lifting speed without load.

The traction battery consumption of power circuit is:

$$Q_{pc} = I_{pc} \cdot \frac{t_{op}}{3600} = 6 \cdot \frac{900}{3600} = 1,5 \text{ Ah} \quad (6)$$

where, I_{pc} – is the power circuit current; t_{op} – is operational time.

Total traction battery consumption is:

$$Q_T = Q_{lm} + Q_{vm} + Q_{ll} + Q_{pc} = 41,723 \text{ Ah} \quad (7)$$

The given calculations can be approximate and should be specified during further research considering the actual values of the forklift operational cycle. Taking into account the traction battery capacity in operations, its rated capacity for 7-8 haul cycles per one shift requires not less than 328 Ah battery. Due to the fact of self-discharge the DIN standard battery with 360 Ah is chosen.

LIST OF REFERENCES

1. Kiehne H.A. Battery technology handbook. – New York.: Marcel Dekker Inc, 2003. – 509 p.
2. Synchuk O.N. Choice of accumulator parameters and types of traction batteries for the mine trolley-battery locomotives / O.N. Synchuk, Yu.B. Filipp, M.N. Maksymov, V.A. Fedotov // CSITA. – 2016. – №5. – P. 1 - 10.