

UDC 658

## THE RATIO OF COSTS ASSOCIATED WITH WAREHOUSE EQUIPMENT AND THE COST OF CARGO HANDLING

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*The article hypothesizes the existence of the dependency of the cost of cargo handling in a warehouse on the cost of storage equipment. The check of hypotheses on the example of vehicles in a warehouse is applied and groundlessness of the assumption is proved.*

In the new economic conditions the important role belongs to the organization of products storage. Well-functioning warehousing, which purpose is loading, storage and shipment of goods, increases the effectiveness of the promotion of products in the supply chain from the point of speed, cost and reliability of the process. Cargo handling – the basis of a warehouse activity – is a circuit that is performed at different stages of the technological process in a warehouse. Therefore you can improve the efficiency of warehouse processes through the development of cargo handling. One way to achieve the desired result is the use of better equipment in a warehouse. However, before you make the right choice in favor of one of the loaders it is necessary not only to learn their functional properties, but also to identify the presence or absence of dependency of the cost of cargo handling on the costs of equipment for its implementation.

Thus, the aim of the research is to study the ratios of investment in equipment and the cost of cargo handling.

The object of the research is conveying equipment used in the process of loading and unloading.

When selecting storage equipment, you must consider their technical specifications to support almost all kinds of operating situations in the warehouse.

Modern warehouse must operate with a minimum use of physical force; ensure the reliability of the movement of goods, fast loading / unloading, maximum comfort and safety. The selection of high-quality machinery and equipment will improve the profitability of not only a warehouse, but also the entire supply chain in general.

Nowadays the choice of warehousing equipment for organizations, enterprises and logistics companies is a difficult decision. The difficulty is choosing between expensive high-tech equipment and cheaper but easier to use equipment.

To solve this problem we studied several types of lifting and handling equipment: reach trucks with electric lift, electric loaders, auto loaders, self-propelled stackers.

To calculate the cost of the equipment per mensem we have calculated the cost of cargo handling as the sum of depreciation, the average salary of the driver, the cost of fuel (diesel or electricity) (Table 1). Notice that all calculations are made in the prices of 1.01.2016 as well as the monetary unit of the old denomination.

Table 1 – Calculation of the cost of cargo handling carried out by various loaders

Loader name	Loader features	Calculation of cost of cargo handling
1	2	3
Reach truck with electric liftseries RSS15, 16+	<ul style="list-style-type: none"> <li>– Equipment cost - 180 million rubles</li> <li>– Capacity 1.6 ton</li> <li>– Driving speed with a load of 8.5 km/h</li> <li>– Battery – 480Ah / 24V</li> <li>– Useful life – 10 years</li> <li>– The duration of the battery T = 28 hours</li> </ul>	<p>The cost of cargo handling:  <math>272.5 + 308.7 + 199.1 = 780,3r</math></p> <p>1) Depreciation and amortization  <math>DE = 180 * 10/55 = 32.7</math> million. rub.- annual depreciation  <math>DE = 32.7 / 12/10000 = 272.5</math> rubles per ton c.</p> <p>2) The salary of the driver loader:  – The path that loader passes for a month in the process of unloading 10,000 tons:  <math>P = 10,000 / 1.6 * 50 * 2 = 625 = 000m</math> 625 km  – The time required for the loader to unload 10,000 tons of c:  <math>T = 625 / 8.5 = 73,5h</math>.  – The cost of 1 hour of driver's truck:  <math>Wh = 7000 h = 000/168</math> RUR 0,042,000. for 1 hour  – Salary of a truck driver (for the transportation of 1 ton c):  <math>S t = 73.5 * 0,042 / 10,000 = 308.7</math> rubles. ton c.</p> <p>3) Fuel costs for truck (electricity)  amount spent <math>kW \setminus h = 73,5 \setminus 28 * 480 = 1260</math>  Fuel costs = <math>1580.2 * 1260 = 1,991,052</math> rubles.  <math>C fuel = 1991052/10000 = 199.1</math> rubles per ton c.</p>

## Economics

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1	2	3
Electric forklift JAC CPD 25	<ul style="list-style-type: none"> <li>- Cost of equipment - 390 million.</li> <li>- Capacity - 2.5 tons</li> <li>- Driving speed with load: 10 km/h</li> <li>- Battery - 620Ah / 48V</li> <li>- Useful life - 5 years</li> <li>- The duration of the battery T = 28 hours</li> </ul>	<p>The cost of cargo handling:  <math>1083.3 + 168 + 217.7 = 1469r</math></p> <p>1) Depreciation  <math>DE = 390 * 5/15 = 130mln. rub.-</math> annual depreciation  <math>DE = 130/12/10000</math> 1083,3rub = 1 ton c.</p> <p>2) The salary of a driver of a loader:  - The path that the loader passes for a month in the process of unloading 10,000 tons:  <math>P = 10,000 / 2.5 * 50 * 2 = 400 = 400 km</math> 000m  - The time required for the loader to unload 10,000 tons of c:  <math>T = 400/10 = 40h.</math>  - The cost of 1 hour of driver's work :  <math>Wh = 7000 h = 000/168</math> RUR 0,042,000.. for 1 hour  - The salary of a truck driver (for the transportation of 1 ton c):  <math>St = 40 * 0,042 / 10,000 = 168</math> rubles. per ton</p> <p>3)The cost of fuel for a truck (electric)  amount of kW / h = <math>40 \cdot 18 * 620 = 1377,7</math>  Energy costs = <math>1377,7 * 1580,2 = 2177041,54</math> RUB.  <math>S El/En = 2177041.54/10000 = 217,7</math> rubles per ton</p>
Auto Forklift JAC CPCD 25+	<ul style="list-style-type: none"> <li>- The cost of equipment RUB 300 million.</li> <li>- Capacity - 2.5 tons</li> <li>- Driving speed with load and 12 km/h</li> <li>- Useful life - 7 years</li> <li>- Engine type diesel/gasoline</li> <li>- Fuel tank capacity – 40</li> <li>- fuel consumption per 100 km = 4.3</li> </ul>	<p>The cost of cargo handling: <math>625 + 139.9 + 19.1 = 784r</math></p> <p>1) Depreciation  <math>DE = 300 * 7/28 = 75mln. rub.-</math> annual depreciation  <math>DE = 75/12/10000</math> 625rub grams per ton.</p> <p>2) The salary of a driver:  - The path that the loader passes for a month in the process of unloading 10,000 tons:  <math>P = 10,000 / 2.5 * 50 * 2 = 400 = 400 km</math> 000m  - The time required for the loader to unload 10,000 tons of c:  <math>T = 400/12 = 33,3h.</math>  - The cost of 1 hour of driver's work:  <math>Wh = 7000 h = 000/168</math> RUR 0,042,000.. for 1 hour  - The salary of a truck driver (for the transportation of 1 ton c):  <math>St = 33.3 * 0,042 / 10,000 = 139.9</math> rubles. per ton</p> <p>3) fuel costs = <math>4.3 * 4 * 11100 = 190920</math> rubles  <math>C fuel. = 190920/10000 = 19.1</math> rubles per ton</p>
Stackers-self-propelled Series FX +	<ul style="list-style-type: none"> <li>- Cost of equipment - 25 mln rubles.</li> <li>The carrying capacity is 1.2 tons</li> <li>- Driving speed with load 5.5 km/h</li> <li>- Battery - 180Ah / 24V</li> <li>- Useful life - 10 years</li> <li>- The duration of the battery is T = 10 hours</li> </ul>	<p>The cost of cargo handling: <math>375 + 635.9 + 430.6 = 1441,5r</math></p> <p>1) Depreciation  <math>DE = 25 * 10/55 = 4,5mln. rub.-</math> annual depreciation  <math>DE = 4.5 / 12/10000 = 375rub</math> grams per ton.</p> <p>2) The salary of a driver:  - The path that the loader passes for a month in the process of unloading 10,000 tons:  <math>P = 10,000 / 1.2 * 50 * 2 = 833 km</math>  - The time required for a loader to unload 10,000 tons of c:  <math>T = 833 / 5.5 = 151,4h.</math>  - The cost of 1 hour of driver's work:  <math>Wh = 7000 h = 000/168</math> RUR 0,042,000.. for 1 hour  - The salary of a truck driver (for the transportation of 1 ton c):  <math>S = 151.4 tons * 0,042 / 10,000 = 635.9</math> rubles. per ton</p> <p>3) fuel costs for a forklift  amount spent kW \ h = <math>151.4 \cdot 10 * 315 = 2725.2</math>  Fuel costs = <math>2725.2 * 1580.2 = 4,306,361</math> rubles.  <math>C el / en = 4306361/10000 = 430.6</math> rubles per ton</p>

Source: own elaboration.

Table 2 summarizes the data on the cost of the purchase of each of the above types of equipment, as well as their operating costs per month (the cost of cargo handling).

Table 2 – The costs for the purchase of equipment and the cost of cargo handling

Name of the equipment	Purchase price, rubles	Cargo handling cost, rubles
Reach truck with electric lift RSS15, 16+	180 000 000	780,3
Electric JAC CPD 25	390 000 000	1469
Autoloader	300 000 000	784
JAC CPCD 25+	25 000 000	1441

Source: own elaboration.

Based on this study we can conclude that it is impossible to predict the cost of cargo handling on the basis of the cost of the loader (if the truck is more expensive, it does not mean that the cargo handling with its use will be cheaper).

Therefore it is necessary to focus on the technical characteristics of the truck to meet the requirements of the warehouse and then choose cheaper loaders from the list.

#### REFERENCES

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