Development of new “ELETRUCK”, High-Speed Climbing and High-power 2-ton Battery-Turret-Truck

Mitsubishi Logisnext Co., Ltd.
Forklift Development Division
Engineering Headquarters
masahiro_yoshioka@logisnext.com

"ELETRUCK" turret trucks of Mitsubishi Logisnext Co., Ltd. account for 70% (approximately 1,000 units) of the approximately 1,500 turret trucks in operation at Toyosu Market. Toyosu Market has been attracting a lot of attention in recent years, and turret trucks operating there have also received a great deal of media exposure. However, competitors have launched new models that are superior to our products in terms of performance and have begun to introduce them to Toyosu Market. Since turret trucks are mainly leased, there was a risk of losing business opportunities if we did not have our new models in time for the next lease contract renewal timing, so we needed to develop a turret truck that had a slope climbing speed equal to or faster than our competitor products, which is a market requirement, in a short period of time.

This report introduces a new type of high-speed climbing turret truck we have developed.

1. Specifications of high-speed climbing 2-ton battery turret truck

Table 1 shows the main specifications of our new turret truck (high-speed climbing type) and competitor product.

Table 1 Main specifications

Truck type			New product	Competitor product
Main dimensions	Overall length	mm	3,330	3,250
	Overall width	mm	1,100	1,115
	Overall height	mm	1,830	1,860
	Platform length	mm	2,000	2,000
	Platform width	mm	1,100	1,100
	Backrest height	mm	565	550
	Wheelbase	mm	1,970	1,930
Max. load	Standard capacity	kg	2,000	2,000
Truck weight		kg	1,070	1,000
Tire	Front	—	4.00-8 SOLID	5.00-8 SOLID
	Rear	—	5.00-8 SOLID	5.00-8 SOLID
Battery	Nominal voltage	V	48	48
	Nominal capacity	AH/5HR	200	200
Travelling motor	Output (60 min. rating)	kW	5.0	4.0
	Control method	—	Inverter	Inverter
Traveling speed	With 2 t load / Without load Flat road in Toyosu Market Area No. 6	km/h	14.5/15.0	14.0/14.0
Climbing speed	**With 1 t load 10% slope in Toyosu Market Area No. 6**	**km/h**	**Competitor product speed +0.54**	**Competitor product speed**

We developed a new traveling motor to enable this new model to achieve an industry-leading slope climbing speed. By selecting a motor that could be installed in this truck from among the core sizes of existing motors and designing a new winding to meet the required specifications, we succeeded in increasing the maximum output by 40% compared to the conventional model within a

limited development period. On the other hand, the increase in motor size was suppressed to 20%, minimizing the changes in the parts for mounting the motor on the truck.

In addition, the maximum output of the controller was increased by 50% to cope with the increased motor output, and the control method during acceleration was changed from conventional torque control to speed control, resulting in improved acceleration performance during slope climbing and traveling with a load.

In order to improve the performance a little further, we increased the wire diameters of the battery cables, motor cables, and cables between the battery modules and changed the contactors, thereby suppressing the voltage drop in the power supply system by 0.85V from the original design. **Figure 1** shows an overview of other changes from the conventional model.

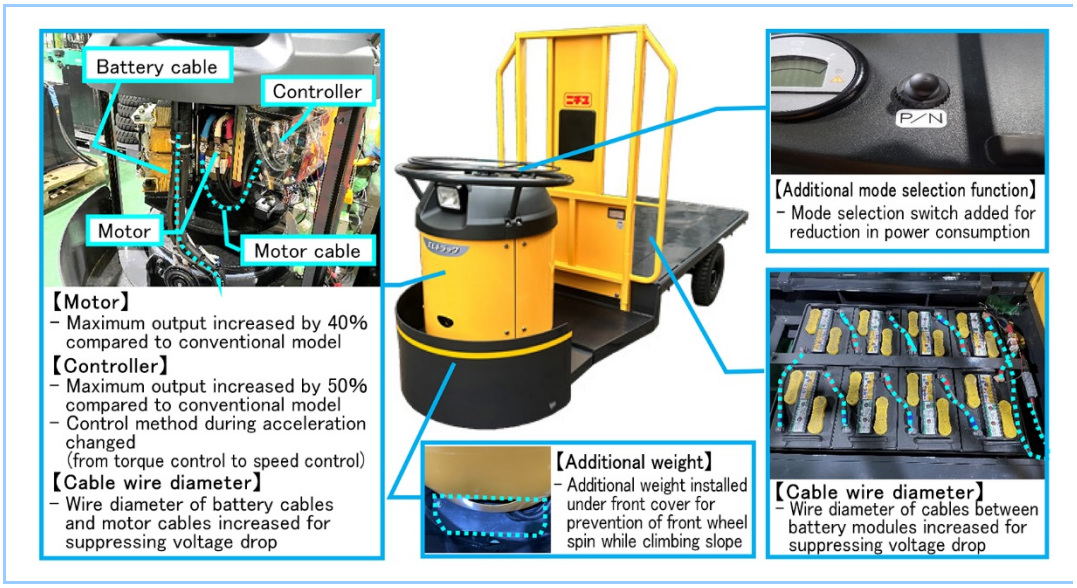

Figure 1 Overview of changes from conventional model

At the start of development, we first obtained all the requests from the customer, divided the requests by the development volume for each component, and after setting a rough estimate of the development period and development cost for each, we examined the specifications that were most likely to preferentially contribute to the outcome of this project. Then we adopted only those that turned out to be absolutely necessary as a result of the examination. In this way, we succeeded in shortening the development period by narrowing down the customer's requests in order of priority. In addition, we were also able to achieve the cost target.

2. Features of high-speed climbing 2-ton battery turret truck

The customer's top priority was a higher performance, in terms of slope climbing speed, etc., than competitor trucks when traveling on slopes at Toyosu Market with a one-ton load.

We brought the prototype truck to Toyosu Market twice and measured its performance on the actual slopes and flat roads of Toyosu Market on-site. Since we develop software and conduct design verification using our test course, we obtained data during the first on-site run at Toyosu Market so that we can convert the data to measurements under the same conditions at our test course. Therefore, during the second on-site run, we were able to achieve the performance we had planned, and furthermore, we were able to confirm the superiority of this truck by running it side-by-side with a competitor truck and obtain a satisfactory evaluation from the customer.

In addition to achieving the industry's fastest climbing speed on the slopes in Toyosu Market, this new model is equipped with a mode select switch (Figure 1) that allows the user to select a power mode from the power mode for high-speed climbing specifications and a normal mode for reduced battery consumption, thus providing benefits to customers who prioritize electricity consumption as well as those who do not use the truck on slopes. Furthermore, the brake power has been enhanced by installing brake regeneration as standard equipment, which also improves safety.

3. Future prospect

We would like to contribute to increasing our market share by demonstrating our newly developed "ELETRUCK" high-speed climbing battery turret truck in markets other than Toyosu Market, and to increase media exposure of this product to raise the profile of our company and our brand.