Development of PREMiA® EM, New Power Pallet Truck for European Warehouse Market

Mitsubishi Logisnext Europe AB

Mitsubishi Logisnext Europe AB develops and manufactures warehouse equipment featuring user-friendliness and ergonomic designs. We were founded in 1958 in Sweden as ATLET AB and in 2017 became a subsidiary of Mitsubishi Logisnext Co., Ltd as UniCarriers Europe AB. We became Mitsubishi Logisnext Europe AB in 2020 and have since been playing a role as one of the European bases of Mitsubishi Logisnext Co., Ltd.

In December 2020, we launched PREMiA® EM, a new power pallet truck with significantly improved functionality and performance for the pallet truck segment of the European warehouse equipment market. This report presents the new PREMiA® EM and explains its main features.

1. Concept of PREMiA® EM

As shown in **Figure 1**, there are various usages of material handling equipment such as forklifts and industrial trucks. Pallet trucks offer quick and easy operability due to their compact body, so they are mainly used for loading and unloading cargo into/from trailers and for transportation between loading bays and warehouses. In contrast to counterbalanced forklift trucks that are generally known in Japan, pallet trucks have the following features.

- Since the truck body is compact, cargo handling works such as load-taking including fork-insertion into the pallet and accurate load-placing at the target location is easy, resulting in improved work efficiency.
- The truck type contributes to improving space efficiency in warehouses.
- Getting on/off the truck is easy, which enables highly-efficient work in warehouses.
- The price is competitive due to the simple truck structure.
- Commonly used in distribution warehouses in Europe together with reach trucks and low-level order pickers.

Figure 1 Usages of material handling equipment

Pallet trucks contribute to the efficiency of logistics as a whole, such as shortening the trailer truck's residence time by the loading bays, so they are a business segment of interest to our main customers—logistics companies—and are positioned as one of the important markets of warehouse equipment in Europe.

PREMiA® EM was developed as one of our core products targeting this important market and has the following features.

(1) Specification development and performance improvement to meet market needs

In general, warehouse equipment is required to have various specifications and customizability, including battery and loading capacity, depending on the usage environment and requests from customers. The following specifications are available for PREMiA® EM. This wide variety of specifications enables optimal trucks that meet diverse market needs.

- Truck size: 3 types according to battery compartment size
- Loading capacity: 2.0 to 2.5 tons
- Battery type: Conventional lead-acid battery, optional Li-ion battery
- Platform: Foldable platform, frame-integrated fixed platform rear entry and frame-integrated fixed platform side entry, 3 variations in total (**Figure 2**)
- Steering system: Mechanical system and 2 variants of electric powered system (**Figure 3**)
- Fork length for cargo handling: 1 to 2.375 m can be selected optionally and other fork lengths are also available as special-order products.

In addition, the truck maximum speed of 12.5 km/h (in the case of an electric powered steering equipped model)—the highest level in its class—and smooth and quick acceleration/deceleration control contribute to safety, comfort and improved work efficiency.

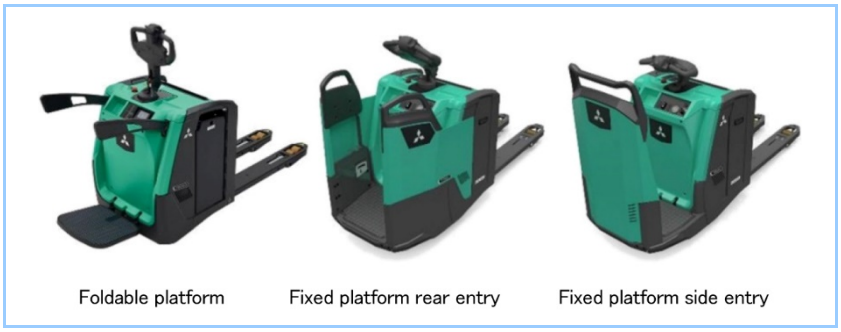

Figure 2 Platform

Figure 3 Steering system

(2) Achievement of both truck stability and driving comfort

Pallet trucks sometimes climb over differences in height at the entrance of trailers or travel on wet surface and are required to have a high truck stability for that reason. On the other hand, they are also required to have driving comfort in order to reduce operator fatigue. In general, there is a trade-off between truck stability and driving comfort and it is difficult to achieve both. However, the newly-developed friction force system and caster wheel system (details described later) achieve both truck stability and driving comfort at a high level.

(3) Strengthening of safety functions

High safety is achieved by adopting a fixed platform with enhanced operator protection functionality, compliance with European safety of industrial truck standard EN1175:2020 and an operator ride detection function (optional), which responds to recent demands for safety performance with respect to higher running speeds and cargo handling speeds for improved work efficiency.

(4) Evolved ergonomic design

In many cases, the same work and the same operation are repeated in transportation work in a warehouse, so an ergonomic design to reduce the fatigue of the operator is required. PREMiA® EM offers class-leading operation comfort with a new-generation tiller head system (details described later), three types of steering systems and a platform damper with a spring force adjustment mechanism (details described later). In addition, stress-free truck operability is attained with a side guard that can be retracted and raised with one hand (**Figure 4**), the optimization of various parameters related to running performance and an intuitive user interface with an optional color display (**Figure 5**).

Figure 4 Side guard

Figure 5 Color display

(5) Total cost reduction by reducing truck downtime

By making the brake maintenance-free, reducing physical wear and the risk of damage using non-contact sensors and improving the dustproof and waterproof performance, truck downtime due to repairs, etc., is minimized. This realizes the reduction of total cost including operating cost and the maximization of operating time.

2. Introduction of new functions

2.1 Friction force system (patent application)

Figure 6 depicts the structure of the friction force system. The drive unit that controls traction and steering of the truck is attached to the truck via the suspension. It reduces the truck vibration due to the uneven floor and increases the contact pressure of the drive wheel by hydraulics. The drive wheel pressure is increased with the load on the forks to improve traction and braking performance. The friction force system uses a guide rod on the suspension and a guide bar for rotation control to restrict the movement of the drive unit only in the vertical direction, realizing a simple and low-cost structure.

This system reduces truck vibration caused by unevenness of ground surfaces and at the trailer entrance to improve driving comfort, and at the same time, increases the contact pressure of the drive wheel to prevent the tire from slipping to ensure truck stability even on slippery ground surfaces.

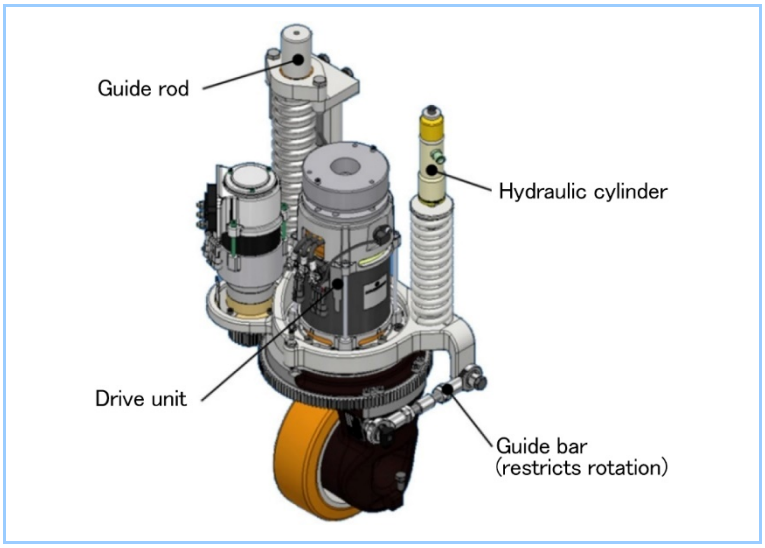

Figure 6 Friction force system

2.2 Caster wheel system (patent application)

Figure 7 shows the caster wheel system consisting of two caster wheels located on the left and right sides of the drive unit. These caster wheels can rotate according to the travel direction of the truck. While the truck is running straight, the caster wheel system reduces truck vibrations caused by ground surface irregularities with built-in springs and while the truck is turning, the maximum vertical displacement of the caster wheels is regulated by restrictors that prevent the truck from tilting and realizes stable running. In addition, the left and right caster wheels are arranged to be slightly offset in the longitudinal direction of the truck to disperse the shock that occurs when the truck goes over a bump.

This system reduces truck vibrations at the time of entering/leaving a trailer, which is normally done by running straight, as well as at the time of high-speed straight running. It also improves truck stability when turning. This system, together with the friction force system described above, realizes both efficient work and the reduction of operator fatigue.

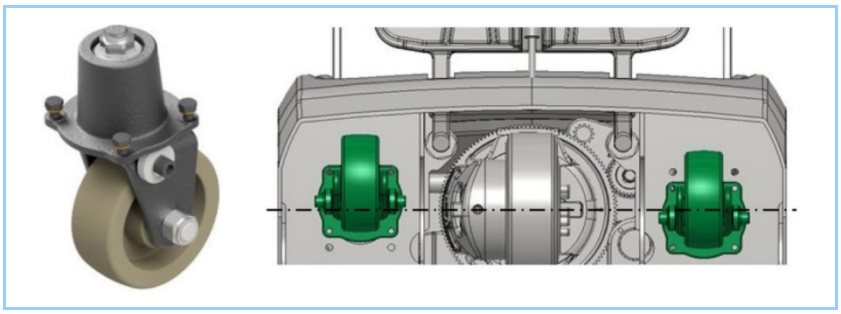

Figure 7 Caster wheel system

2.3 New-generation tiller head system

Figure 8 shows the new-generation tiller head system. This system consists of a tiller head and controls. The positions and angles of the controls are optimized based on ergonomics and are patented. This new-generation tiller head system enables simultaneous operation of truck driving (with the accelerator and brake) and cargo handling, as well as stress-free operation when driving backwards, which is common during long distance transportations. In that case, the operator operates the truck, standing sideways using one hand, while looking back. This contributes to reducing operator fatigue. In addition, this system features dustproof and waterproof performance compliant with IP65 protection class, which improves the robustness for outdoor and cold store work. This new-generation tiller head system adopted first for PREMiA® EM will be adopted sequentially for new trucks in the future.

Figure 8 New-generation tiller head system

2.4 Platform damper mechanism

The newly-developed platform damper mechanism shown in **Figure 9** has high vibration damping performance that has been optimized to reduce the amount of vibration that the operator is subjected to. Trucks with a fixed platform offer a damper mechanism as optional equipment for which the spring force can be adjusted according to the weight of the operator (**Figure 10**). The spring force of this mechanism can be adjusted with a convenient switch. Figure 10 gives an example of a change in the floor surface position (the position where the spring force and the weight of the operator are balanced) due to a change in the spring force with the same operator onboard. By weakening the spring force when the operator weight is light and increasing it when the operator is heavy, vibration reduction and driving comfort improvement independent of

operator weight have been realized.

Figure 9 Platform damper

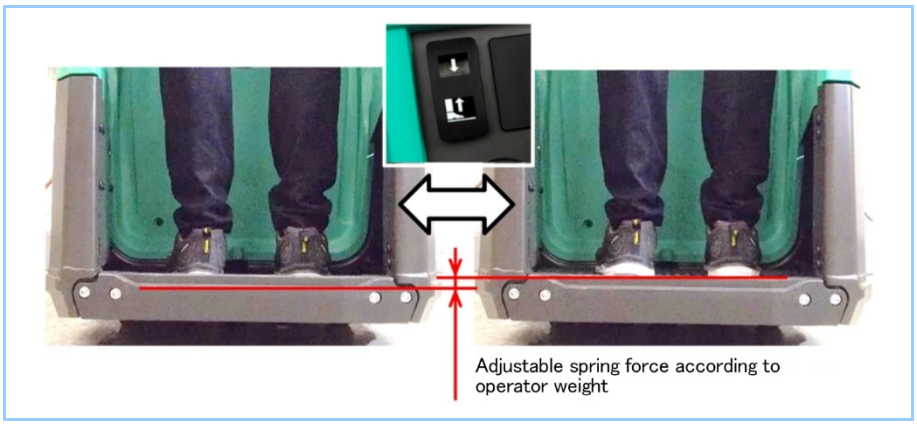

Figure 10 Platform damper with spring force adjustment mechanism

3. Future development

The new functions and features of PREMiA® EM presented in this report are scheduled to be sequentially rolled out to new trucks in the future and such new trucks are expected to be very appealing products for customers and greatly contribute to the European business of Mitsubishi Logisnext Group. We will continue to develop warehouse equipment that pursues efficiency, user-friendliness and ergonomics.