

New Traigo80 2.0-3.5 ton Electric Counterbalance Forklift

新型電動フォークリフトTraigo80(2.0-3.5トン)の開発

Francesco Mastroianni

*1 Toyota Material Handling Manufacturing Italy S.p.A.

Abstract The New Traigo80 (2.0-3.5 ton) is 9th generation 80V EL CB (Electric CounterBalance forklift) developed by TMHMI (Toyota Material Handling Manufacturing Italy S.p.A.) from 2018 to 2021. The Counterbalance Forklift 2.0-3.5 ton is one of the largest market in EU, however, in the past, the largest part of the trucks within this range were IC CB (Internal Combustion CounterBalance forklift), due to the required performance in terms of Power, Durability and Operating Time. On the other hand, under the influence of always higher and higher environmental demands, the increasing customers' request is to shift from IC CB to EL CB. New Traigo80 is enabling users to switch to EL CB instead of using trucks with IC CB by having "Higher power", "Higher durability" and "Long operating time" than conventional to improve productivity and provide a comfortable working environment to the operator by achieving "Low noise", "Low vibration", and "High ergonomics".

Keywords: Electric Forklift, Ergonomics, Display, Armrest, Lithium-ion battery

要旨 新型Traigo80(2.0-3.5トン)は2018年から2021年にかけてTMHMI(Toyota Material Handling Manufacturing Italy S.p.A.)で開発した9シリーズの80V電動カウンターバランスフォークリフトである。これまで欧州での主要ボリュームゾーンでの2.0-3.5トン車では求められる性能(出力・耐久性・稼働時間)によりエンジン車の高シェア状態が続いてきた。一方で世の中の環境に対する関心の高まりを受け、お客様のエンジン車から電動車へシフトする要望も高まってきている。新型Traigo80は従来車より出力・耐久性・稼働時間を高め生産性を高めると共に低騒音・低振動・高いエルゴノミクス性を達成することで、お客様に電動化へのシフトの機会を提供すると共にオペレーターへ快適な作業環境を提供することを可能にした。

キーワード: 電動フォークリフト、エルゴノミクス、ディスプレイ、アームレスト、リチウムイオン電池

1 Background and introduction

The 8-series Toyota 2.0-3.5 ton Electric CounterBalance forklift was launched in 2013 and it was the first step to increase our share in this growing segment. The 80V is growing faster and is becoming a more dominating factor seeing a shift from IC CB to EL CB over the years linked to environmental benefits for customer (No NOx, PM) and society (CO₂) due to more stringent emissions regulations on IC CB, specifically diesel. In addition, this new generation looks to support product appeal with improved appearance, ergonomics and features to exceed the competitor's forklifts.

Key points

1) Competition leading performance

- (1) Noise
- (2) Vibration
- (3) Energy consumption
- (4) Productivity

2) Wide list of Options

- (1) Color touch display
- (2) Low hydraulic noise system
- (3) Lithium-ion battery
- (4) Lever and joystick



Figure 1 New Traigo80 Appearance

2 Features and Benefit

1) Competition leading performance

- (1) Noise
Lowest noise values towards the driver achieved thanks to the fully Floating Cabin and new low noise pump with helical gear.

An extensive range of cabin options provides weather protection, increasing comfort and enhanced safety making it easier to take on long shifts both inside the warehouse and in the yard.



Figure 2 Floating Cabin



Figure 3 Low noise pump

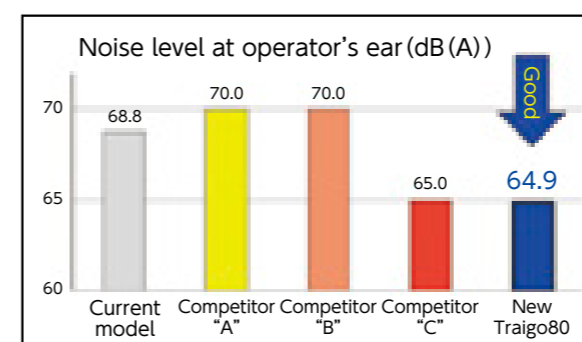


Figure 4 Noise level comparison

(2) Vibration

Thanks to the new fully Floating Cabin and suspension system design, the vibrations transferred to the driver are minimized, reaching lowest values in the market.

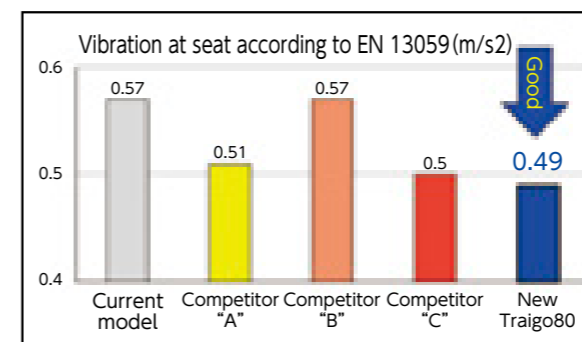


Figure 5 Seat Vibration level comparison

(3) Energy consumption

Lowest energy consumption mainly due to a new generation pump motor with permanent magnetics (IPM motor). With IPM motor the number of lift is higher in the same time and more with one battery charging.

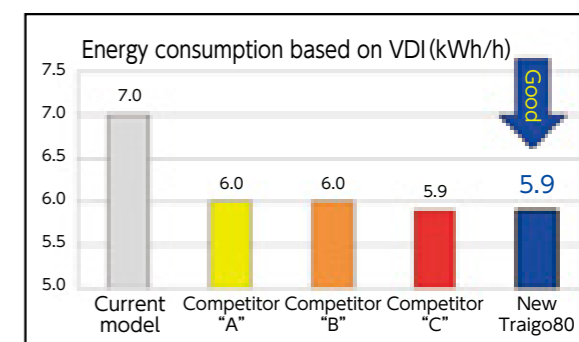


Figure 6 Energy consumption comparison

(4) Productivity

'Easy battery exchange and charging'

The new standard open chassis design which is open on side and bottom of the frame allows easy and quick lateral battery exchange by using another forklift. Additionally there is an easy access to battery for maintenance.



Figure 7 Open Frame for easy battery exchange

Also available: Lithium-ion Batteries made in-house (420 Ah and 630 Ah). With an integrated charging plug it is possible to charge the truck in a fast and safe way without opening the side panel. This charging plug is called "Kobra plug" and it is in common with WH (Warehouse forklift).



Figure 8 Lithium-Ion Battery (Made in TMHMI)

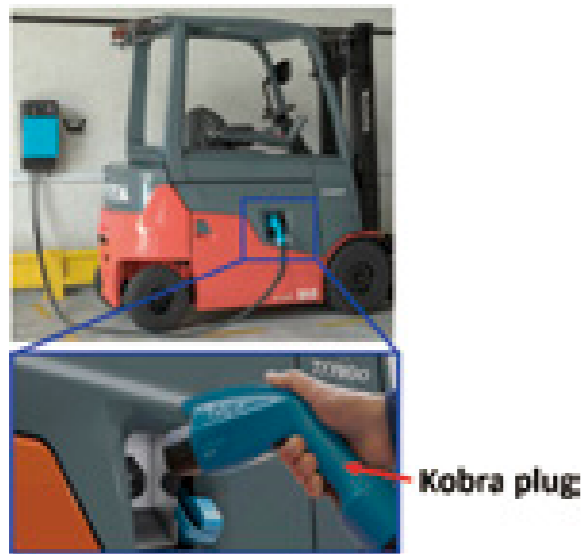


Figure 9 Easy charging with Kobra plug

3 Detailed design - New Armrest

The new Armrest is the prominent innovative feature of the New Traigo80 interior. From the beginning a big focus was placed on user-centric design, usability, and ergonomics. The design was ideated from the very start by using VR technology and corroborated during the development with advanced ergonomics studies following the expertise of Dresden University.

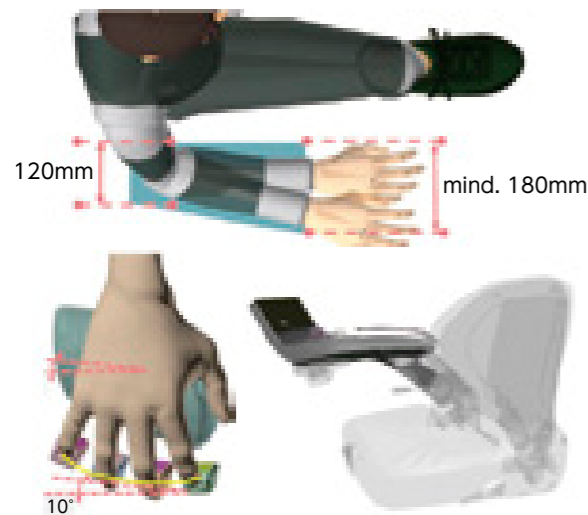


Figure 10 Ergonomic study on the armrest position

The New Armrest was designed to offer a common family feeling with the WH (Warehouse forklift) style which was designed by TMHMS (Sweden), achieved by sharing colors, symbols and design elements such as the mini levers. Furthermore, the graphic layout and

functionality of the Touch Screen user interface has a common theme and shared assets, giving a similar look and feel to the CB and WH screens. This armrest will be implemented to other CB.



Figure 11 Family design with WH

The Armrest is available in multiple configurations with two different types of Display (Touch screen and standard) with mini levers, multi-functional joystick and mini joystick



Figure 12 Mini Lever



Figure 13 Multi-functional Joystick



Figure 14 Mini Joystick

The multi-functional touchscreen provides easy interaction between truck and driver. The standard multi-functional display provides more traditional interaction.

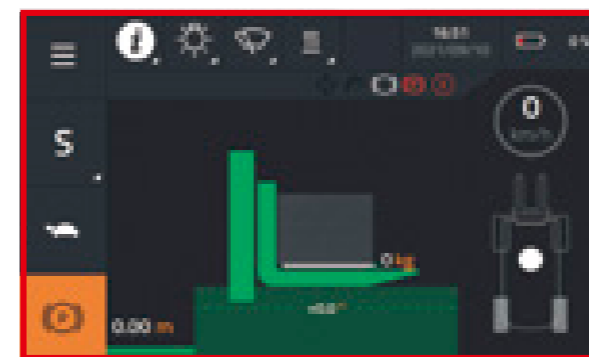


Figure 15 Multi-functional touch screen display (7 inch)



Figure 16 Standard multi-functional display (3.5 inch)

A patent granted for the function that the hand control device vibrates as an alert when the clamp interlock is released. Four other patents are pending.



Figure 17 Patent of hand control device vibration

4 iF DESIGN AWARD 2022

The design was highly rated and won the iF DESIGN AWARD. The iF DESIGN AWARD is one of the most prestigious design awards worldwide. It is organized by the Hannover, Germany-based iF International Forum Design GmbH, a design organization with the longest history in the world, founded in 1953. In 2022, more than 10,000 entries were received from 57 countries and regions. New Traigo80 was award after rigorous judging by an expert jury.

製品技術紹介



Figure 18 IF DESIGN AWARD 2022



Figure 19 New Traigo80 Appearance

■ Author ■



Francesco Mastroianni
TMHE CB R&D Director

5 Conclusions

The sales result 6 months after commercial launch was 150% exceeded target sales volume. The range 2.0-3.5 ton is going to become more and more one critical segment in the market. The applications are several and severe. The new family trucks will be a big step forward to increase market share.

Improving Ergonomics has become every day more important. The human interface is critical also for the newest request from the new generations

- Touch screen display
- High performance radio
- USB charging ports