

## Introduction of Products

### Electric Mini Excavator PC30E-6/PC33E-6

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*PC30E-6/PC33E-6 is a new type of electric mini-excavator with longer operating hours, a more compact body, and expanded functional equipment for full-scale market release in Japan and Europe, inheriting the zero-emission and low noise features which were well received in the conventional model, the PC30E-5. This report provides an overview of the new model.*

**Key Words:** PC30E-6, PC33E-6, Electric mini excavator, Lithium-ion battery, Stationary fast charger

## 1. Introduction

In order to reduce greenhouse gas emissions, Komatsu has set a challenging goal of becoming carbon neutral by 2050. By officially releasing the new electric mini excavators PC30E-6/PC33E-6 in Japan and Europe, the company aims to create a market for electric excavators and achieve “safe, productive, smart, and clean work sites of the future.”



Fig. 1 PC30E-6

Table 1 Main specifications

Item	Unit	Developed model PC30E-6	Conventional model PC30E-5
Overall length	mm	4,560	4,950
Overall width	mm	1,560	1,740
Overall height	mm	2,520	2,580
Machine weight	kg	3,580	4,730
Tail swing radius	mm	1,020	1,420
Motor output	kW	17.4	17.4
Battery type	-	Lithium-ion	Lead-acid
Battery capacity	kWh	35	36
Continuous operating hours	h	3.0	2.5
Charging time (stationary fast charge)	h	1.8 (20→100%)	1.2 (20→80%)
Charging time (on-board normal charge)	h	No normal charging	12 (20→100%)

## 2. Aims of development

The conventional model, PC30E-5 (released in March 2020), has been praised for its electrified advantages over internal combustion engine (ICE) machines, such as not needing to worry about exhaust fumes when working indoors, its quietness making it easy to communicate with other workers, lack of engine heat resulting in lower risk of fire and an operator's seat that doesn't get hot, and less vibration such that you don't get tired as easily. However, we also received requests for improvements, such as the large tail swing radius creating a risk of hitting something around it, the heavy weight of the machine preventing it from being transported by a 4-ton truck, the desire for longer operating hours, and the desire to top up the charge during breaks.

In addition to incorporating the improvements mentioned above, the development of the PC30E-6/PC33E-6 has brought improvements to maintainability and comfort, greatly increasing the appeal of the product. The outline and features of this model are described below.

- (1) Environmental performance
  - ZERO exhaust gas
  - Noise reduction
- (2) Operating performance
  - Same operating performance as ICE machines
  - A more compact machine size
  - Extended operating hours
- (3) Electric components
  - Lithium-ion battery
  - Stationary fast charger
- (4) Maintainability
  - Significant reduction in daily inspection items and periodic replacement parts
  - Separate layout of high voltage and hydraulic components
  - Tilt-up mechanism
- (5) Comfort and functionality
  - Operator's seat heater
  - Monitor display for electric mini excavator
  - Rear view camera/monitor
  - LED light
  - Addition of storage compartment
  - Enhanced with other standard equipment

## 3. Major features

### 3.1 Environmental performance

#### 3.1.1 ZERO exhaust gas

The PC30E-6 is equipped with an eco-friendly battery and electric motor, so it emits no exhaust gases during operation. In addition, the amount of CO<sub>2</sub> emitted when generating power at a power plant is reduced by approximately 40% compared to ICE machines.\*1 \*2

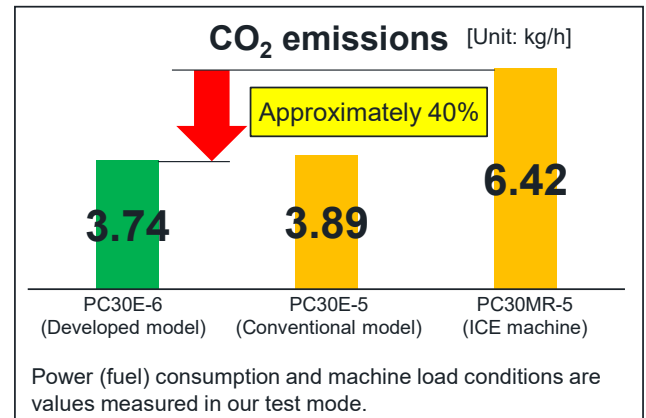


Fig. 2 Comparison of CO<sub>2</sub> emissions

\*1: CO<sub>2</sub> emissions for PC30E-5/PC30E-6 are associated with electricity consumption, and the emission factor is based on the alternative value of the general electricity transmission and distribution utility published in July 2023 in Japan.

\*2: The CO<sub>2</sub> emission factor for PC30MR-5 diesel is based on the emission factor list from the Ministry of the Environment in Japan.

#### 3.1.2 Noise reduction

The PC30E-6 is equipped with an electric motor instead of an engine, which means there is no engine noise and it is much quieter than conventional construction machinery. In particular, compared to the ICE machine (PC30MR-5), noise at the operator's ears has been reduced by more than 6 dB.

### 3.2 Operating performance

While maintaining the same work performance as ICE machines, the machine has been made more compact and its operating hours have been extended.

### 3.2.1 Same operating performance as ICE machines

The hydraulic components used are the same as those used in conventional ICE machines. Since it uses an electric motor with the same output as a ICE machine, the basic operating performance is equivalent.

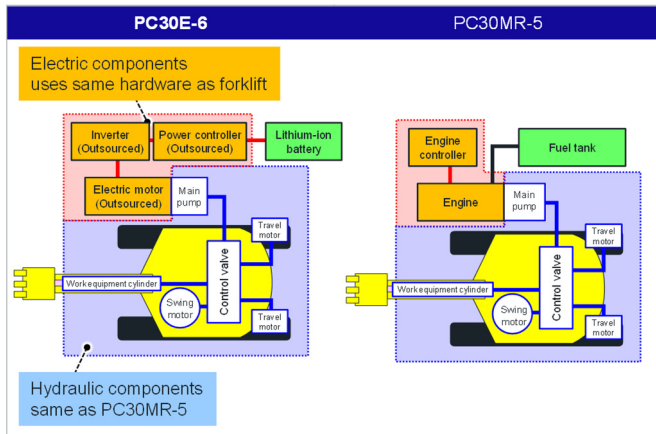


Fig. 3 Comparison of components

Working modes include the powerful P mode for a heavy workload, the E0 mode for reduced power consumption, and the E1 mode which reduces power consumption even further. Electric motors provide stable output even at low speeds, enabling powerful operation even at low speeds where torque drops in ICE machines.

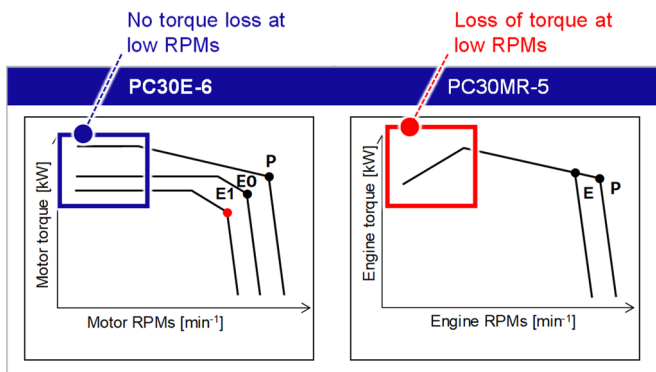


Fig. 4 Comparison of torque curve comparison

In addition, the motor torque does not drop even at high loads, improving operating efficiency. Even in E0 mode, the same workload is ensured as in P mode for ICE machines.\*3

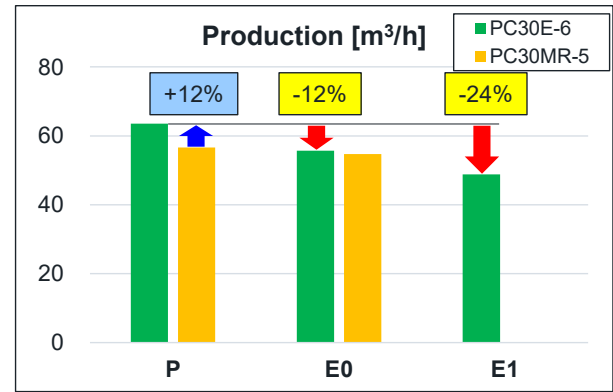


Fig. 5 Comparison of workload

\*3: All data are from our own tests and may vary depending on the operating mode.

### 3.2.2 A more compact machine size

By installing a high-energy density lithium-ion battery, adopting electric components from an electric forklift, and simplifying the electrical and cooling systems (Fig. 6), both the machine weight and machine dimensions have been significantly reduced compared to the PC30E-5 (Table 2, Fig. 7).

These measures reduce the possibility of the rear end collisions when turning, and also make it possible to transport the machine on a 4-ton truck.

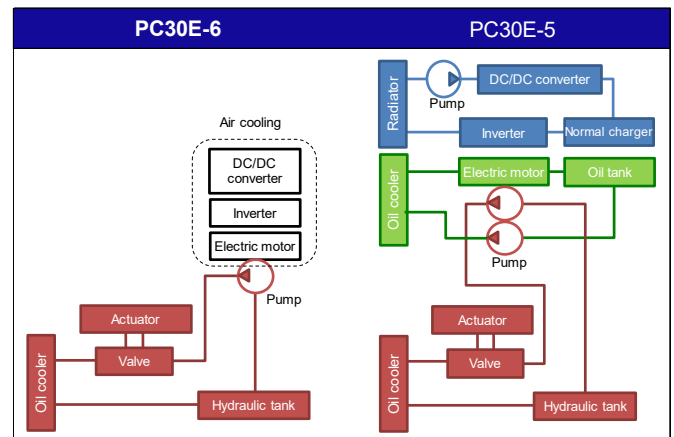


Fig. 6 Comparison of cooling systems

Table 2 Comparison of machine weight and machine dimensions

	PC30E-6	PC30E-5	PC30MR-5 Arm crane version
Machine weight	3,580 kg	4,730 kg	3,300 kg
Tail swing radius	1,020 mm	1,420 mm	810 mm
Overall width	1,560 mm	1,740 mm	1,550 mm

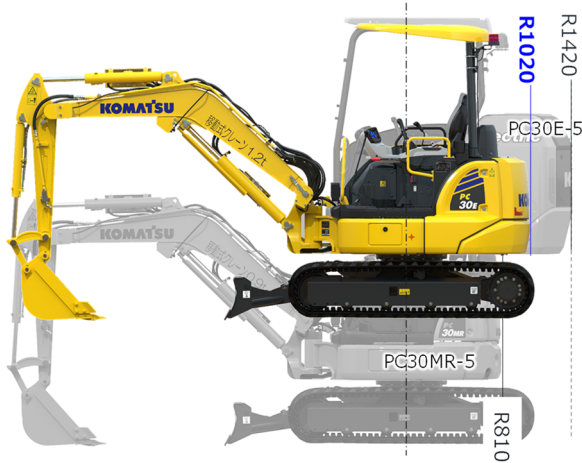


Fig. 7 Comparison of tail swing radius

### 3.2.3 Extended operating hours

By reducing the machine weight and changing the electric components, power consumption has been reduced and the operating hours have been extended by 20%, from approximately 2.5 hours for the PC30E-5 to approximately 3 hours for the PC30E-6. (Operating hours vary depending on the operating site and workload.)

#### (1) Power saving mode

Operators can further extend the operating hours by switching the working mode to E0 or E1. Compared to P mode, E0 mode can reduce power consumption by approximately 15%, and E1 mode can reduce power consumption by approximately 30%.

#### (2) Quick top-up charging

Combining a lithium-ion battery with a fast charger makes it possible to charge quickly, such as during a break. Also, compared to lead-acid batteries, which reduce the charging current when the battery capacity exceeds 80%, a fast charger allows for full charging while maintaining a high current, helping with continuous operation.

## 3.3 Electric components

### 3.3.1 Lithium-ion battery

#### (1) Lithium-ion batteries with many advantages over lead-acid batteries

We have adopted lithium-ion batteries, which have little self-discharge and can be repeatedly charged and discharged.

- Compared to the lead-acid battery used in the PC30E-5, the use of a lithium-ion battery with high

energy density helps make the machine more compact.

- The lithium-ion battery has a lifespan that is more than three times longer than lead-acid batteries, extending the battery replacement interval.
- Unlike lead-acid batteries, it does not produce lead sulfate crystals (sulfation), so there is no need for refresh charging to remove them.

#### (2) Same battery packs as the FE series of electric forklifts

These shared battery packs have a proven track record in electric forklifts, and by changing to a vertical two-tier configuration, the structure is tailored to fit the chassis space. Additionally, the battery management system is housed in a sheet metal case that matches the components layout, with a commonized internal structure.

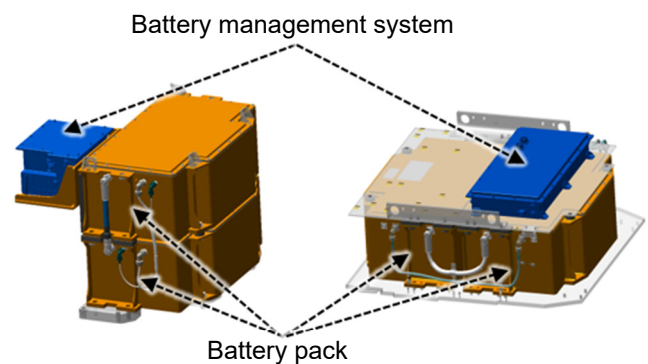


Fig. 8 Comparison between PC30E-6 (left) and FE25G-2 (right)

#### (3) Battery management system

To secure safe use of the lithium-ion battery, a battery management system, which runs independently of the machine controller, is installed on the battery. The system continuously monitors the voltage of each cell, the temperature of each module, the voltage and current of the packs and other parameters. When the system detects out-of-range values, it shuts down the discharge and charge circuits.

The battery management system communicates with the machine controller, and when it detects any abnormality, it takes appropriate actions such as limiting machine output in stages and displaying warning messages on the monitor panel on the machine to minimize operational risks.

Additionally, to compensate for the weakness of

lithium-ion batteries, which is deteriorated performance at low temperatures, a heater is automatically activated when the battery temperature drops, ensuring that operating hours at low temperatures are not affected.

### 3.3.2 Stationary fast charger

(1) Adopting the charger for the FE series of electric forklifts

By adopting the above charger, the following improvements have been made compared to the PC30E-5 fast charger:

- Compact size achieved by changing to a dedicated charging method (Table 3).
- In addition to being lifted by crane, it can also be transported by forklift.
- You can check charging status and charger information on the LCD panel.

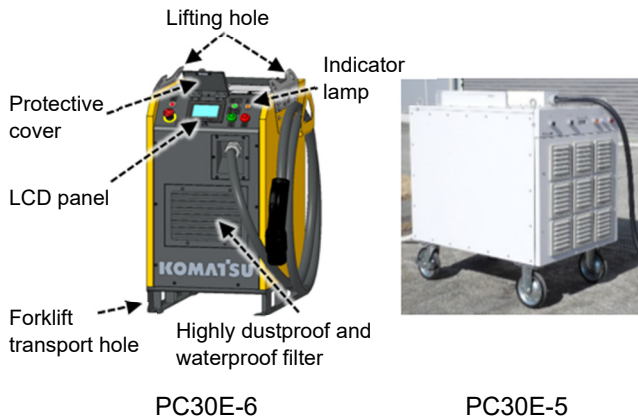


Fig. 9 Appearance of the fast charger

Table 3 Comparison of dimensions and weight of fast charger

	PC30E-6	PC30E-5
Width (W)	540 mm	700 mm
Depth (D)	650 mm	1,095 mm
Height (H)	856 mm	1,130 mm
Weight	105 kg	280 kg

(2) Designed for outdoor charging

The following modifications were made to the electric forklift charger, which was designed for charging indoors or under the eaves, to enable outdoor charging as well.

- Highly dust-proof and waterproof filter is standardized to improve dust-proof and waterproof rating (IP54).
- Improved weather resistance by adding a UV protection cover to the LCD panel.

- Improved visibility on sunny days with increased luminance and blinking indicator lamp.

(3) Adding charger specifications for Europe

The PC33E-6 charger supports an input power supply voltage of 400 VAC three-phase to suit the power supply conditions in Europe. It also comes with a CEE plug, which is the mainstream method of connecting to a distribution board in Europe, making it easy to install the charger.

### 3.4 Maintainability

#### 3.4.1 Significant reduction in daily inspection items and periodic replacement parts

Since neither engine- nor fuel-related check items exist, daily inspection items and periodic replacement parts have been significantly reduced (Table 4, Table 5). Daily inspection of the high-voltage components concentrated at the rear is not required.

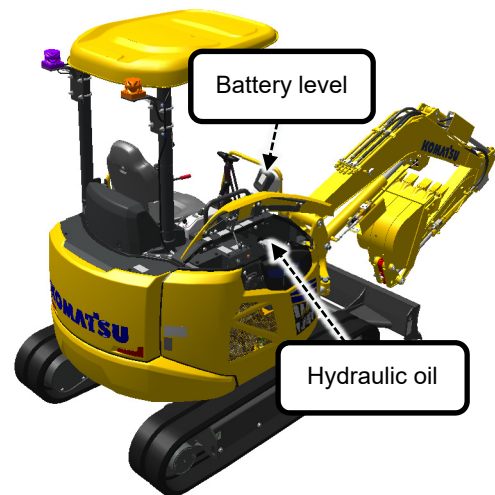


Fig. 10 Daily inspection

Table 4 Daily inspection items (7 to 3 items)

●: Required, -: Not required

Inspection items	PC30E-6	PC30MR-5
Drain mixed water and sediment from fuel tank	-	●
Check the dust indicator	-	●
Check the water separator and drain water and sediment	-	●
Check the oil level in hydraulic tank, add oil	●	●
Check the coolant level, add coolant	-	●
Check the electric wiring and the horn	●	●
Check the fuel level (battery level)	●	●

Engine- or fuel-related check items

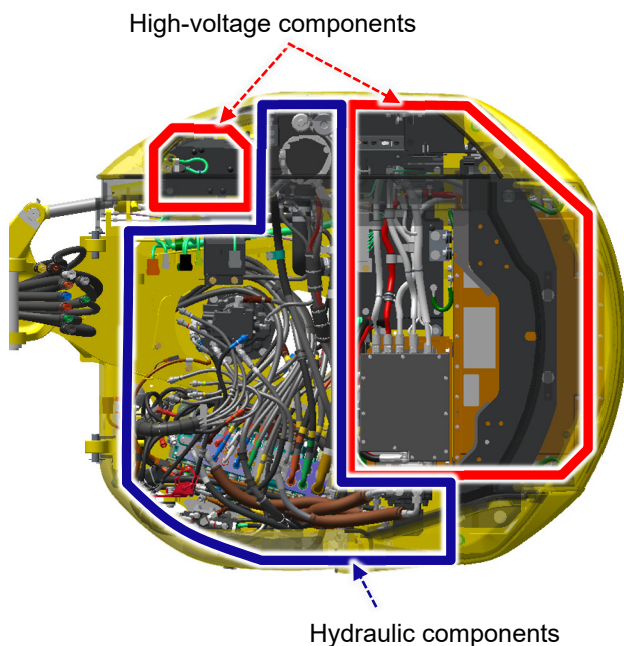


**Table 5** Periodic replacement parts (9 to 7 items)  
 ●: Required, -: Not required

Replacement parts	Recommended replacement interval (h)	PC30E-6	PC30MR-5
Grease	100	●	●
Engine oil filter	500	-	●
Fuel filter	500	-	●
Hydraulic tank breather	500	●	●
Final drive gear oil	1,000	●	●
Hydraulic oil filter	1,000	●	●
Hydraulic tank strainer	2,000	●	●
Hydraulic oil	2,000	●	●
Accumulator	4,000	●	●

### 3.4.2 Separate layout of high voltage and hydraulic components

The high-voltage and hydraulic components are separated, allowing work to be done safely without having to worry about high-voltage components. In addition, by tilting up the floor, inspection of the hydraulic components can be performed in the same way as ICE machines.



**Fig. 11** Layout of high voltage and hydraulic components

### 3.4.3 Tilt-up mechanism

It employs a tilt-up mechanism similar to that of ICE machines. When performing full-scale maintenance, the floor can be tilted up along with the operator's seat, allowing workers to keep an eye on every corner inside of the machine, enabling accurate and quick work.



**Fig. 12** Tilt-up mechanism  
 (from the photograph in the catalog)

## 3.5 Comfort and functionality

### 3.5.1 Operator's seat heater

Electric foot heaters are standard equipment. Because they are electrically heated, the temperature rises quickly, allowing you to work warmly from the start even in cold weather.



**Fig. 13** Operator's seat heater  
 (from the photograph in the catalog)

### 3.5.2 Monitor display for electric mini excavator

The monitor display has been completely redesigned to display various caution notices and machine information in an easy-to-understand layout. Not only can you see the machine's status at a glance, such as the battery level, but you can also check operation records, charging energy usage, electricity prices, and cumulative CO<sub>2</sub> emissions with the simple press of some buttons.



Fig. 14 Comparison of monitor displays

### 3.5.3 Rear view camera/monitor

The CAB version employs a rear monitor system consisting of a high-resolution CMOS camera with a 120-degree viewing angle and a 7-inch monitor. Improved visibility to the rear of the machine allows for safer work.

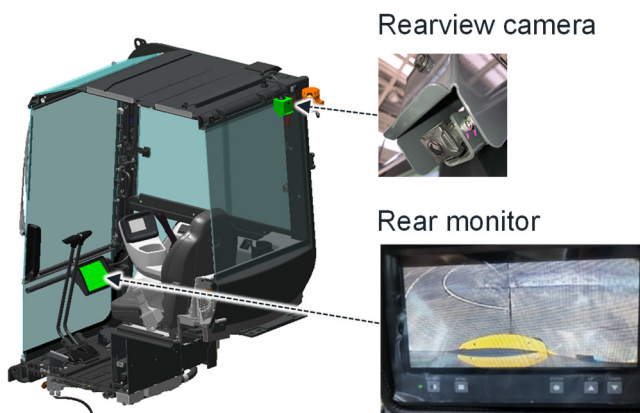


Fig. 15 Rear view camera/monitor

### 3.5.4 LED light

Diffused LED lights are used for the working lamp and traveling lamp. Compared to the halogen lights of conventional models, which were prone to localized glare, this model can emit light evenly, improving workability and safety when working at night or while driving.

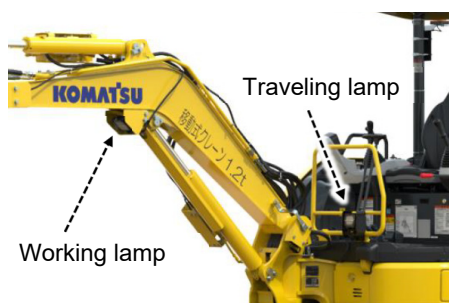


Fig. 16 Working lamp and traveling lamp

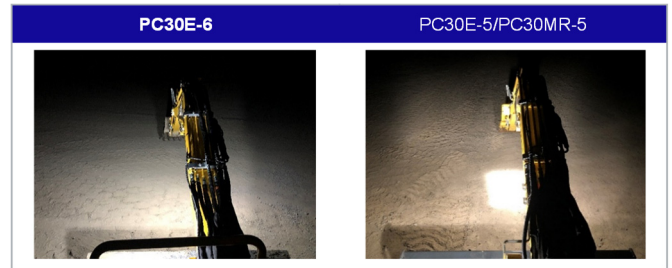


Fig. 17 Comparison of LED light (left) and halogen light (right)

### 3.5.5 Addition of storage compartment

Compared to conventional models, there are more storage compartments around the operator's seat, making it more convenient.



Fig. 18 Addition of storage compartment

### 3.5.6 Enhanced with other standard equipment

Equipped with equipment that is often installed on ICE machines as standard, enhancing versatility so that it can be used for a variety of worksites and applications.

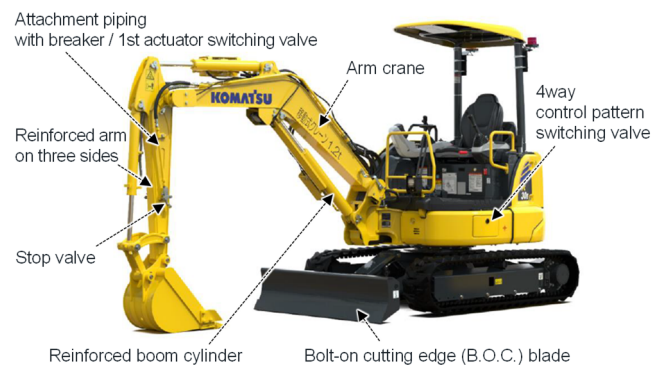


Fig. 19 Other standard equipment (PC30E-6)

## 4. Conclusion

In Japan, Komatsu released the PC30E-5 in March 2020, ahead of other companies, and it has been well received by a wide range of customers and worksites. This time, Komatsu has addressed the issues identified there through the introduction of the PC30E-6/PC33E-6 electric mini excavators, which are also targeted at Europe, where demand for electrification is on the rise. The incorporation of a lithium-ion battery makes the machine size almost as compact as a ICE machine, and we believe that this mini excavator will be able to provide a clean working environment even in tight spaces.

We also received a favorable response at our booth at Intermat in Paris, France in April 2024, and with the cab version now available on the market, shipments in Europe are also increasing. We will continue to work on developing machines that are clean, smart, and user-friendly, including expanding our series.



**Fig. 20** Intermat demonstration

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### [A comment from the authors]

This development project has been carried out with the goal of releasing a “popular model” of electric mini excavators to the market. Despite many challenges during quality checks, we are deeply grateful that the PC30E-6/PC33E-6 could be successfully released to the market. This achievement was possible thanks to the support from various departments, including the forklift and the electric components development departments that led the way with the lithium-ion battery, as well as the product planning, sales, production departments, and our suppliers.

In today’s world, environmental awareness is high. We believe that battery-powered solutions are just one of the many options available. We will continue to develop products that please our customers, without sticking to just one solution.