

## Introduction of Products

# Development of Electric Micro Excavator and Initiatives for Popularization

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Komatsu introduced the electric micro excavator “PC01E-1” into the market in 2022 while conducting a collaborative research with Honda Motor Co., Ltd. (“Honda”), aiming to achieve carbon neutrality at the construction worksites using construction machinery.

This article introduces “PC05E-1” brought into the market in October 2023 as a model to expand the “PC01E-1” series.

**Key Words:** PC01E-1, PC05E-1, Electric micro excavator, New value creation

## 1. Introduction

Our development of electric micro excavators and initiatives for their popularization are as follows: Through the joint development with Honda, we are promoting dissemination of electric excavators by introducing a variety of electric equipment on civil engineering and construction worksites, such as electric micro excavators, into our smart

and electric operations, working with Honda’s electric mobility and power products. We also aim to develop a broad network of battery-sharing systems for use in the civil engineering and construction industries by making use of the detachable portable battery Honda Mobile Power Pack (“MPP” \*1) in collaboration with Honda. (Fig. 1)

\*1: Honda Mobile Power Pack is a portable and swappable mobile battery developed by Honda.



**Fig. 1** Establishment of broad-ranging battery-sharing system network through utilization of MPP (conceptual diagram)  
(Cited from Press Release on Komatsu’s corporate website)

## 2. Aims of development

The PC01E-1 introduced in 2022 was appreciated for its practical advantages such as no exhaust gas emissions unlike engine-powered models, quietness, and ease of replacing a MPP.

On the other hand, however, requests were made for improvements against the issues such as the tail swing radius increased by installing the MPP, and the changed stability due to the resultant backward movement of the vehicle's center of gravity position.

The above improvements were considered in the development of the electric micro excavator PC05E-1 (**Fig. 2**): Achievement of the tail swing radius and stability equivalent to those of engine-powered models not only meets the needs of small-scale civil engineering works and gas, electricity, and in-house piping systems as in the past but also leads to our efforts to create a new value by making use of the features of electric excavators.

The outline and features of this model are described below.

- (1) Environmental performance
  - ZERO exhaust gas
  - Noise reduction
- (2) Operating performance
  - More powerful digging performance than that of engine-powered models
  - Achieving both stability and compactness by applying a midship layout
- (3) Maintainability
  - Significant reduction of inspection items
- (4) Versatility
  - Equipped as standard with hydraulic outlets for attachments



**Fig. 2** PC05E-1

(Cited from Press Release on Komatsu's corporate website)

## 3. Major features

### 3.1 Environmental performance

#### 3.1.1 ZERO exhaust gas

Electrification has realized "zero" exhaust gas emission at worksites, reduced environmental impact, and enabled working comfortably in various working environments, whether they be indoors or outdoors.

No exhaust gas is emitted, which eliminates the need to worry about plants dying due to waste heat or ventilation when working in greenhouses or indoors.

#### 3.1.2 Noise reduction

Installation of an electric motor as a power source has eliminated the noise caused by engines and achieved tremendous quietness compared with engine-powered models. (**Table 1**)

Noise reduction reduces the construction noise in residential areas, etc., making the operators, workers, and the residents in the vicinity stress-free, and making it easier to communicate with the excavator operators, which can be expected to lead to the improvement of the safety at the worksites.

**Table 1** Comparison of noise levels

Item	Unit	PC05E-1	PC05-1
Noise level	dB	81 *2	92

\*2: Under application for the certification as "Super Low Noise Construction Machinery by the Ministry of Land, Infrastructure, Transport and Tourism of Japan."

### 3.2 Operating performance

#### 3.2.1 More powerful digging performance than that of engine-powered models

With use of electric motors capable of working effectively in the whole speed range, the work equipment's cycle time in a high speed range has reached the performance equivalent to that of engine-powered models, and besides, they can demonstrate powerful excavability even in a low-speed work at which engine-powered models are weak. (Fig. 3)

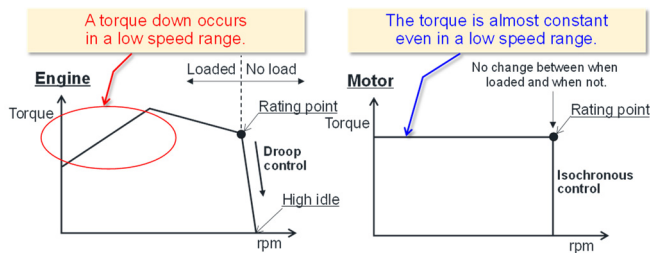


Fig. 3 Difference in rotation speed control between engine and motor

#### 3.2.2 Achieving both stability and compactness by applying midship layout

The compactness, stability, and weight equivalent to those of engine-powered models are achieved by containing the MPP and electric power unit inside the battery hood. (Table 2)

As a result, the turning performance and digging workability equivalent to those of an engine-powered model are achieved, which enables the machine to be used in an equal way to an engine-powered model, such as work in a tight space, which is required for hydraulic excavators, and transportation on a 1-ton truck.

Table 2 Main specifications

	PC05E-1	PC05-1
Machine mass	520 kg	500 kg
Overall length (for transport)	2,300 mm	
Overall width	690 mm	
Overall height (for transport)	1,230 mm	
Tail swing radius	700 mm	

This article introduces the following design methods used to achieve compactness, as an example.

#### (1) Integration of power supply control devices

Various devices required for controlling the electric power unit, such as the down regulator, contactor, relays and fuses, are modularized and concentrated in one place, which has contributed to space saving. (Fig. 4)



Fig. 4 Power supply control unit

#### (2) Location of electric fan in space inside machine cover

Since the heat sources such as a hydraulic tank and a hydraulic pump and the electric power unit are contained in the compact machine body, there are concerns that the electric power unit may fail due to overheating.

Therefore, the PC05E-1 locates the electric fan in the space inside the machine cover (Fig. 5), keeping the temperature of the electric power unit from rising and achieving continuous operation for a long period of time.

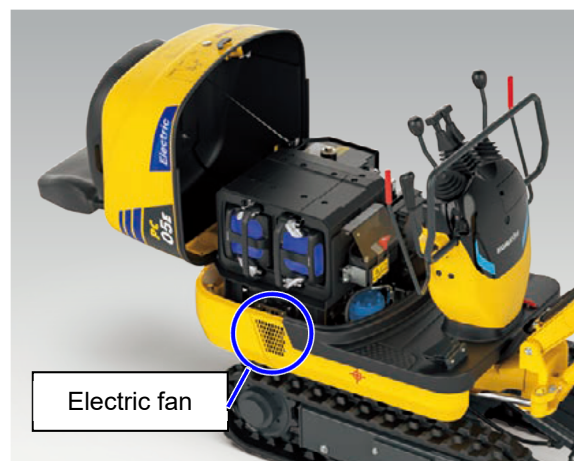


Fig. 5 Electric fan located inside machine cover (from the photograph in the catalog)

This model also considers ease of replacing a battery as well as the compact body. The MPP is installed sideways and smoothly slid in the storage box, which has resulted in reduction of the load applied when the pack is inserted and removed, and improvement of the handling for replacement.

### 3.3 Maintainability

#### 3.3.1 Significant reduction of inspection items

Electrification eliminates the checking, cleaning, and replacement of air cleaners, filters, and engine oil and fuels, which are not required any longer. That leads to a significant reduction of the daily check and maintenance (Table 3) and occasional maintenance (Table 4), which take time and effort.

**Table 3** List of periodic check and maintenance items  
●: Required; -: Not required

Check and maintenance items	PC05E-1	PC05-1
Change the oil in the engine oil pan and clean the engine oil filter.	-	●
Lubricate.	●	●
Replace the fuel filter element.	-	●
Replace the hydraulic oil filter cartridge.	●	●
Check and refill the oil in the final drive case.	●	●
Replace the engine oil filter.	-	●
Change the oil in the hydraulic tank and replace the strainer.	●	●
Change the oil in the final drive case.	●	●

**Table 4** List of occasional maintenance items  
●: Required; -: Not required

Occasional maintenance item	PC05E-1	PC05-1
Check, clean and replace air cleaner.	-	●
Check the battery electrolyte level.	-	●
Check the rubber shoes.	●	●
Check and adjust the rubber shoes track tension.	●	●
Replace the rubber shoes.	●	●
Drain water and sediment from the fuel tank.	-	●
Check and adjust the engine valve clearances.	-	●
Bleed air from hydraulic circuit.	●	●

### 3.4 Versatility

#### 3.4.1 Equipment as standard with hydraulic outlets for attachments

The PC05E-1 is equipped as standard with hydraulic outlets for attachments (Fig. 6), and therefore can be used by connecting hydraulic attachments (hydraulic hand tools). (Fig. 7)

We are working on creating a new value of electric micro excavators utilizing hydraulic hand tools in collaboration with the attachment manufacturer, as efforts to expand the applications by making use of the features of electric excavators, such as quietness and zero exhaust gas emission.

We have confirmed the practical usability of hydraulic hand tools on the PC05E-1 and their advantages in electrification, and furthermore, exhibited the hydraulic hand tools together with the PC05E-1 at the 35th International Agricultural Machinery Show in Obihiro 2023 and at the Formula SAE Japan 2023, where the affinity between electric micro excavators and hydraulic hand tools was demonstrated. (Fig. 8)

Combination of “an electric excavator” and “hydraulic hand tools” can be expected to be used in the indoor dismantling and building renovation fields in addition to the previous small-scale worksites such as civil engineering and gas, electricity, and in-house piping sites.



**Fig. 6** Hydraulic outlets for attachments (from the photograph in the catalog)



**Fig. 7** Example of using hydraulic outlets for attachments: Breaker





Fig. 8 PC05E-1 and hydraulic hand tools on display

#### 4. First presentations at external exhibitions

We displayed the PC01E-1 at the experience-based store “b8ta” held at four locations in Saitama, Osaka, Fukuoka, and Nagoya in 2022, as well as the construction industry related exhibitions, and were able to receive feedback from many people, including women and children.

(Fig. 9)

The PC05E-1 was also exhibited at the Honda booth in the “JAPAN MOBILITY SHOW 2023” in 2023.



Fig. 9 Exhibited at b8ta in Koshigaya Laketown  
(Cited from Komatsu’s corporate website)

#### 5. Conclusion

This article introduces the PC05E-1 launched at the Japanese market in October 2023.

Since introduction of PC05E-1 has added more features, such as quietness and zero exhaust gas emission, brought about by electrification, it is now found that their applications have new possibilities that have never been seen before, such as the applications expanded to indoor use.

In order to contribute to further dissemination in the electrification market which is still underdeveloped, we would like to continue our efforts to develop electric construction machinery in pursuit for the added values to be provided by electrification, making use of the knowledge gained through this development.

## Introduction of the authors



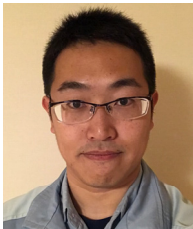
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## [A comment from the authors]

With a great deal of cooperation from the suppliers and people within the company as well as our co-researchers, this development has brought us to our success in the mass production of the product as a product that strongly emphasizes the advantages of electrification. We would like to express our gratitude to everyone involved in the activities.

We were able to receive many favorable comments from the visitors to the exhibitions and our customers. We would like to continue developing products that will make our customers smile.