

## Introduction of Products

### Introduction of PC228US-8 Hydraulic Excavators

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*Komatsu developed hydraulic excavator PC228US-8 and put it on the market under the concept of “Environment”, “Safety”, and “IT”. The technologies used for and feature of this product are introduced in this paper.*

**Key Words:** *Environment, safety, IT, fuel consumption reduction*

#### 1. Introduction

PC228U-3EO conformed to the emission regulations was full-model-changed to PC228US-8 and put in the market in August, 2006. This new model has many selling points to upgrade the marketability mainly based on “environment”, “safety”, and “IT” which are the basic strategy of Model 8 Series. This paper reports the outline of this model. (Fig. 1, Fig. 2)



**Fig. 1** PC228US-8  
(Extract from PC228US-8 Sales Manual)

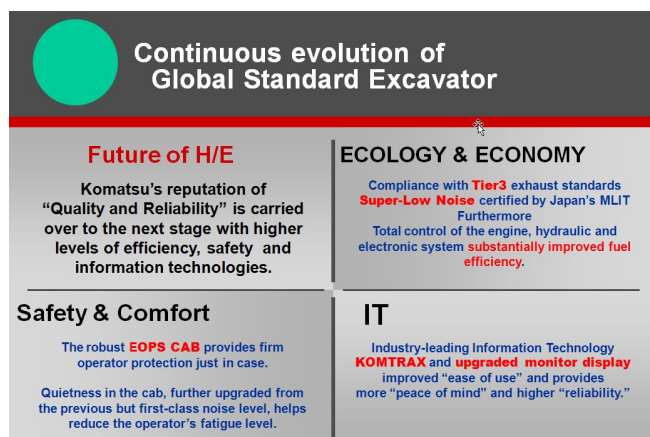


Fig. 2 Development concept  
(Extract from C79 reference material)

## 2. Aims of Development

Komatsu US series tight quarter excavators are used widely in from narrow jobsites of pipe laying work to general civil engineering jobsites and highly evaluated for their safety and working performance etc. By the model change of this time, the new model is upgraded by attaching the higher fuel consumption reducing technology on the basis of the basic concept of "environment", "safety", and "IT" for the current model PC200. The following are the outline and features of this new model.

### (1) Environment policy

- Conformance with emission regulations in Japan, USA, and Europe
- Fuel consumption reduction by 12% compared to current model
- Fuel saving operation guidance is displayed on monitor panel
  - ECO gauge
  - Idle stop caution
- Reduction of ambient noise
  - Conformance with ultra low noise regulation of Ministry of Land, Infrastructure, Transport and Tourism
  - Conformance with EU 2nd Noise Regulation

### (2) Safety and operator comfort

The following were employed to develop the new model as a global machine which would clear the strict safety standards in the world and would be highly comfortable.

- Newly designed large-sized comfortable roll-over protective structure (ROPS) cab
- Large-sized foldable mirror (Conformed to ISO)
- Rear view monitor system (Standard)
- Low noise inside cab

### (3) IT

Evolve the IT further to provide "more information" which is "easier to read" and "easier to use".

- New large-sized color LC multi monitor
- Function switch
- Air conditioner switch and display built in monitor panel
- Upgraded KOMTRAX function

### (4) Improved maintainability

Small-sized hood

## 3. Selling Points

Based on the foregoing, the selling points of PC228US-8 and the technologies required to accomplish them are described.

### 3.1 Environment

#### 3.1.1 Conformance with emission regulations

The engine on PC228US-SE0 conformed to the emission regulations is mounted. Since the electronically controlled high pressure fuel injection system (HPCR (High Pressure Common Rail)) is employed, high injection pressure is obtained and assured optimum control of multi-stage injection and injection timing. Low NOx and Low PM are attained by employing 4 intake valves and 4 exhaust valves, setting the injection nozzle to the center of the cylinder and optimizing the shape of the combustion chamber. (Fig. 3)



Electronically Controlled Common Rail Engine

Fig. 3 Engine  
(Extract from C79 reference material)

#### 3.1.2 Reduction of fuel consumption

##### (1) Matching control of new engine and pump

The fuel economy is further improved by lowering the engine speed in the light/medium load range from the output characteristics of the existing engine conformed to Tier 3 regulation in addition to using the matching control technology employed for PC200-8. (Fig. 4, Table 1)

With the above improvement, the engine and pump can be

matched at the optimum fuel efficiency on the engine fuel consumption map and the fan horsepower and fan noise are reduced. As a result, the actual fuel consumption during the 90-degree swing, excavating and loading operation in the P mode is reduced about 12% compared with the current model. The fuel efficiency (production volume per fuel consumption) is about 13% increased under the above condition. (Table 2)

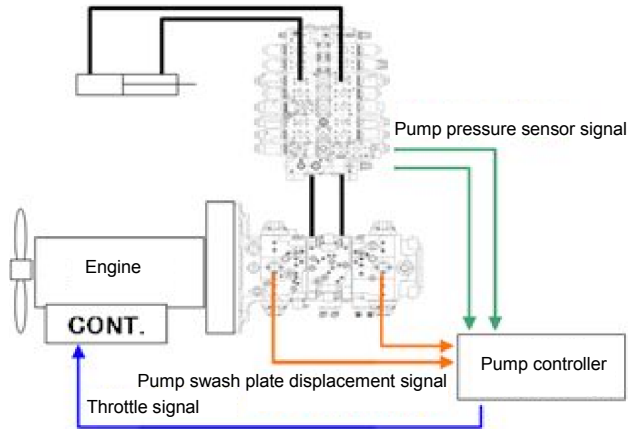
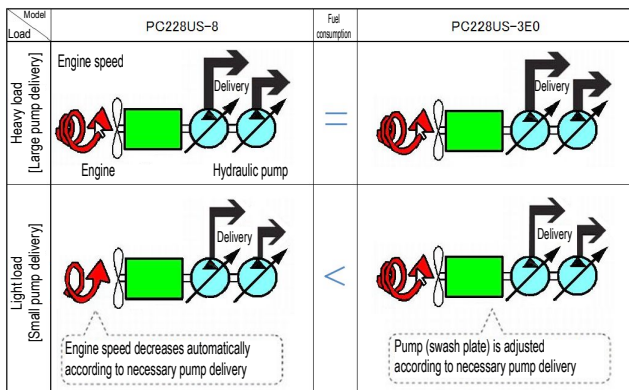


Fig. 4 Matching system of new engine and pump (Extract from C79 reference material)

Table 1 Matching control of new engine and pump



(Extract from PC228US-8 Sales Manual)

Table 2 Comparison of fuel consumption

Item	Machine model	Komatsu PC228US-8		Komatsu PC228US-3E0	
		P mode	E mode	P mode	E mode
	%	100	87	100	85
	%	88	81	100	85
	%	113	107	100	101

(Extract from PC228US-8 Sales Manual)

(2) Size increase of pipe for work equipment

The size of the hydraulic piping of the bucket bottom line is increased to reduce the flow route resistance, hydraulic loss, and fuel consumption.

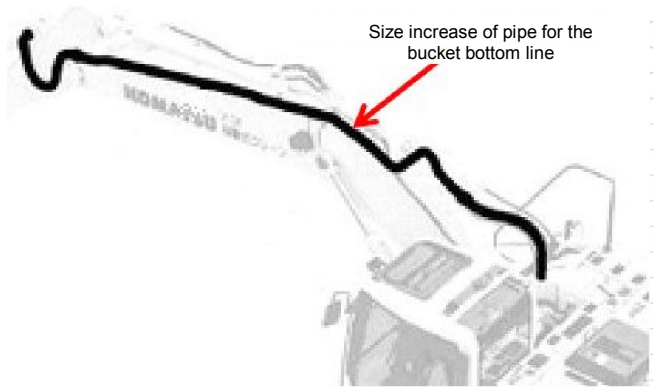


Fig. 5 Increase of piping size (Extract from PC228US-8 Sales Manual)

(3) Reduction of auto-deceleration speed

The fuel consumption is reduced by further decreasing the deceleration speed while the levers are in neutral position.

Table 3 Auto-deceleration speed

Item	Machine model	rpm	
		Komatsu PC228US-8	Komatsu PC228US-3E0
Low idle speed	rpm	1050	1050
Deceleration speed	rpm	1050	1400

(Extract from PC228US-8 Sales Manual)

3.1.3 ECO gauge and idle stop caution

The gauge to indicate the fuel consuming condition of the machine is displayed on the right side of the multi monitor screen. If the load becomes high, the gauge zone changes from the green to the orange to notify the operator. If the engine runs at idle speed for a certain time, the message appears on the monitor urging the operator to stop the engine idle. (Fig. 6, Fig. 7)

Fuel consumption is displayed by indicator ("ECO gauge")



Green range indicates energy saving operation

**Fig. 6** ECO gauge  
(Extract from PC228US-8 Catalogue)

Displayed when engine continuously runs at idle speed



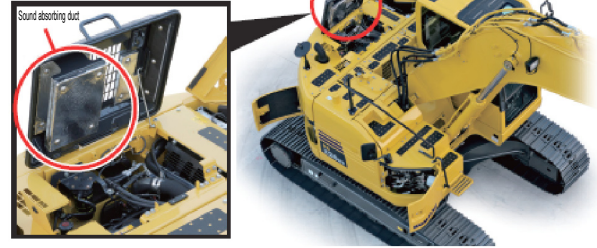
**Fig. 7** Screen of idle stop message  
(Extract from PC228US-8 Catalogue)

### 3.1.4 Reduction of ambient noise

This model cleared the ultra low noise regulation of Conformance with ultra low noise regulation of Ministry of Land, Infrastructure, Transport and Tourism (Regulation value of PC200 class: Below 100 dB). It attained the standard value by decreasing the muffler noise, employing the exhaust duct in the engine hood (**Fig. 8**), mounting the cooling shroud to decrease the aerodynamic noise of the fan, and arranging the sound absorbing materials properly.

Sound insulation and sound absorption technologies are fully used.

- Low-noise muffler, sound absorbing duct
- Proper layout of sound insulating wall material and sound absorbing material



**Fig. 8** Exhaust duct  
(Extract from PC228US-8 Sales Manual)

## 3.2 Safety and operator comfort

The safety and operator comfort are further improved by adding the following to the former design of the safety and operator comfort.

### 3.2.1 Roll-over protective structure (ROPS) cab

Many of the accidents of the hydraulic excavator operators are caused by rolling over. Protection of the operator when the machine rolls over is very important in the aspect of safety. The cab of PC228US-8 is strengthened greatly to protect the operator from rolling over. The new cab has a pipe frame. When the machine rolls over, the deformation of its cab is limited to a certain range to protect the operator in it. Accordingly, the safety of the operator is secured even if the machine rolls over one turn. (**Fig. 9**, **Fig. 10**)



**Fig. 9** ROPS cab  
(Extract from PC228US-8 Catalogue)



**Fig. 10** ROPS cab  
(Extract from the test report)

### 3.2.2 Large-sized foldable mirrors

Since the large-sized mirrors are employed, the safety on the right side and left side can be checked sufficiently. These mirrors and the rear view monitor described below secure the safety. The right front mirror and the left mirror which projected from the chassis are foldable so that they can be folded inward easily for transportation. (Fig. 11)



**Fig. 11** Large-sized foldable mirrors  
(Extract from PC228US-8 Sales Manual)

### 3.2.3 Rear view monitor system

The rear view monitor is installed as standard, instead of the former rear view mirror. This monitor greatly contributes to the safe operation for the operator. (Fig. 12)



**Fig. 12** Rear view monitor system  
(Extract from PC228US-8 Catalogue)

### 3.2.4 Reduction of noise in cab

The noise in the cab (dynamic noise at operator's ear) is reduced by 1 dB compared to the current model by reducing the noises from the engine and air conditioner blower motor, etc., employing the new cab having high rigidity and sound isolation effect, and optimizing the sound isolation and absorption function of the machine body.

### 3.2.5 Large-sized comfortable cab

The width is increased from Model 3 cab and the floor area is increased 11% as a result. The wide front view and sufficient foot space are attained to provide comfortable operation environment, together with reduction of noise in cab and

employment of the new large-sized multi monitor. In addition, the opening/closing operating effort of the door is reduced 15 - 20% by improving the shape of the slide rail. (Fig. 13, Fig. 14, Table 4)



Fig. 13 Large-sized comfortable cab  
(Extract from PC228US-8 Sales Manual)

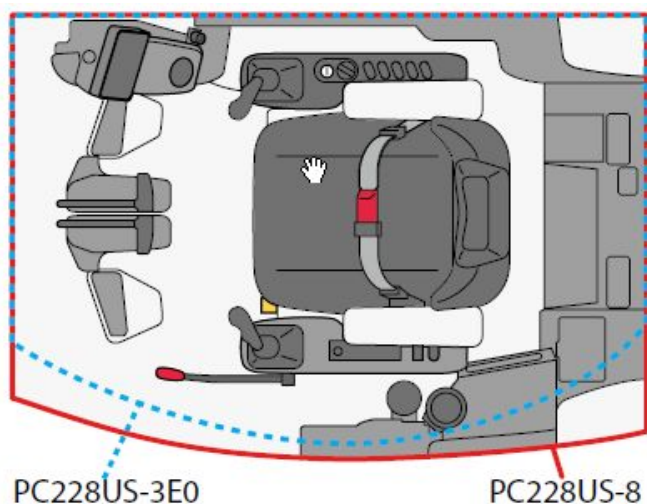


Fig. 14 Large-sized comfortable cab  
(Extract from PC228US-8 Sales Manual)

Table 4 Improvement of shape of door slide rail

Machine model	PC228US-8	PC228US-3E0
Upper roller and rail		
Center roller and rail		
Lower roller and rail		

(Extract from PC228US-8 Sales Manual)

### 3.3 IT

#### 3.3.1 New large-sized color multi monitor and switches

The viewability of the monitor is greatly increased by using the 7-inch TFT (Thin Film Transistor) LCD panel having high resolution.

The function switches are employed for multiple functions. In addition, the air conditioner switch function is installed to the monitor switch for the ease of operation. The monitor is a multi-lingual monitor, allowing selection from 12 languages. (Fig. 15, Fig. 16)

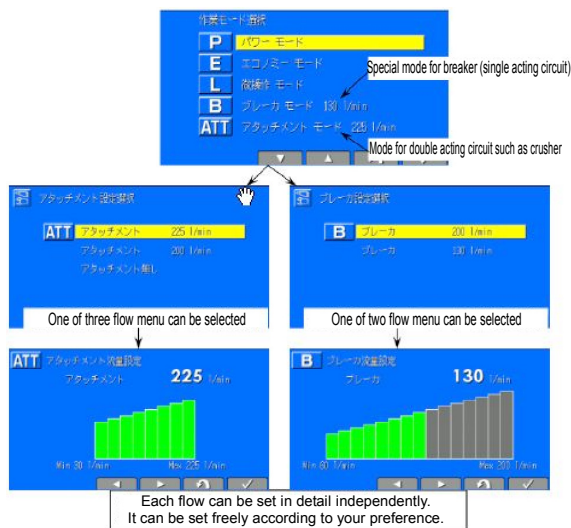
There are two types of flow rate to select in the breaker mode, and there are three types of flow rate in the attachment mode so that various attachments can be applied. (Fig. 17)



Fig. 15 New large-sized color multi monitor and function switches  
(Extract from PC228US-8 Catalogue)



**Fig. 16** Multi-lingual monitor  
(Extract from PC138US-8 Technical Report)



**Fig. 17** Attachment mode  
(Extract from PC138US-8 Technical Report)

**3.3.2 Upgrading of KOMTRAX function**

The function of the KOMTRAX employed on and after Model 3 is further improved to provide the customers with “safety” and “reliability”.

KOMTRAX was developed as a system to save the information of the operating position and operating condition of each machine in a Web server through the communication devices by the GPS technology and provide that data to the distributors, GR, and users through the Internet and has been used effectively to grasp the operating condition of the machines from remote places, provide the parts and machines timely, grasp machine troubles from remote places, and increase the speed of troubleshooting and repair.

This time, the burglar proof function is reinforced and the function of downloading the data and distributing the data with cellular phones is added. The burglar proof functions include setting a password to prevent a third person from starting the engine without permission, a time reservation lock and a calendar reservation lock, allowing the setting of an engine start lock (immobilizer).

**3.4 Improvement of maintainability**

**3.4.1 Small-sized hood**

While the hood on the counterweight of Model 3 is made in one unit, it is divided and reduced in size for the new model to reduce its opening/closing operating effort for the ease of maintenance work. (Fig. 18)



**Fig. 18** Small-sized hood  
(Extract from PC228US-8 Catalogue)

**4. Conclusion**

The market needs are turning toward low-fuel consumption machines that are gentle to the environment, and we have succeeded in putting PC228US-8 which has effects in reducing CO2 by attaining the target fuel consumption in the market. We expect that this model having the same operating performance with PC200 which is our main product will be evaluated high.

**Introduction of the writers**



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**[A few words from writers]**

With the concept of “environment”, “safety”, and “IT” for PC200-8, we attached the fuel consumption reduction technology to PC228US-8 prior to Tier 4 in the circumstances of Lehman Shock and high rise of prices of steel and fuel, and put it in the market successfully. We hope this model will be highly evaluated in the market.