

Introduction of Product

Introduction of Large Hydraulic Excavator PC2000-8

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Further refining the “Dantotsu” keywords “Environment,” “Safety” and “IT,” the new PC-2000-8 has been developed with achievement of “economy” as well as the “Dantotsu” features. The background to development and technology incorporated in the new product are described.

Key Words: PC2000-8, hydraulic excavator; US EPA Tier-2 exhausted gas regulation, low fuel consumption, low R&M cost, Dantotsu, power container

1. Introduction

Since the PC1600 was introduced into the market in 1988, Komatsu’s large hydraulic excavators have been in active service at mines, quarries and large earth moving sites throughout the world. Quality improvements have been incorporated in them using the experiences gained at these sites, fostering them as stable products.

Nevertheless, their basic performance had not been changed and an enhancement has been necessitated in their product power, which has relatively lowered in the face of changing of models made in competitor machines.

The engine installed in them did not comply with the new exhausted gas regulations of Japan, the United States and Europe and installation of a new engine has been demanded.

Against such a background, a full changing of models has been made and “Dantotsu” quality has been incorporated to drastically upgrade the product capability as outlined below.

2. Aim of Development

The hydraulic excavators of this class are mainly engaged in digging and loading work at mines, quarries and large earth moving sites. In Japan, there was large demand in 2000 and 2001 in connection with the construction works related to the Kansai International Airport.

The number of large hydraulic excavators of this class sold outside of Japan is steadily increasing reflecting the

rapid increase in the global demand for resources. This trend is anticipated to continue further.



Fig. 1 Full view of PC2000-8

As dump trucks to be combined, the optimum combination is the HD785 class, which has the largest number of units operating in the world.

“Dantotsu” (Environment, safety and IT) + Economy

- (1) Low fuel consumption
- (2) Clean engine and low noise
- (3) Safety design and comfortable cab
- (4) Large monitor display and VHMS (Vehicle Health Monitoring System)

3. Principal Features

3.1 “Economy” - Low fuel consumption

1) Accomplishment means and effects

Through a reduction in hydraulic pressure losses achieved by using new technologies, the PC2000-8 economizes fuel consumption by about 10% in the E0 mode compared with PC1800-6. (Fig. 2, Fig. 3)

(1) Reduction contribution ratio

Reduction in hydraulic pressure loss	Reduction in fan loss	Reduction in PTO loss
70%	20%	10%

(2) Accomplishment contribution means and breakdown of factors

Aim of development	Accomplishment means	Reduction ratio
Reduction in fuel consumption	Reduction in hydraulic pressure loss • Gear pump eliminated → Self pressure reducing valve • Pipe size: #14 → #20 (cyl. bottom line) • Independent swing circuit → Priority swing (Swinging pump and valve eliminated)	-7%
	Reduction in fan loss Hydraulically driven fan and rotation control	-2.0% (at outside air temp. of 20°C)
	Reduction in PTO loss 2-stage meshing → 1-stage meshing	-1.0%

Fig. 2 Means to accomplish low fuel consumption

Item	Model	Komatsu PC2000-8			Komatsu PC1800-6
		Mode P	Mode E0	Mode E1	Mode DH
Work cost ratio		105	100	96	100
Fuel cost		95	90	83	100
Fuel efficiency cost		110	110	115	100

Fig. 3 Comparison of work rate and fuel consumption

* Values are ratios (indexes) based on Mode DH of the PC1800-6 as 100.

Work conditions

- Loading of blasted rocks
- 90° swing backhoe loading
- Suitable for 78t dump trucks

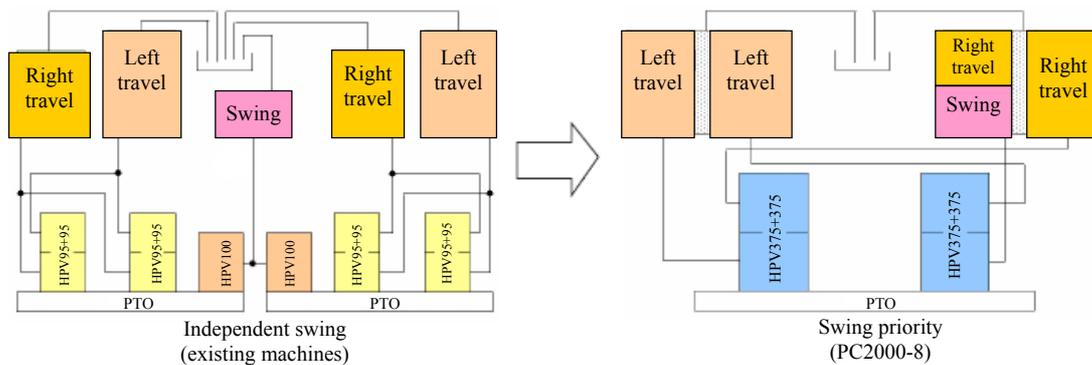


Fig. 5 Swing system

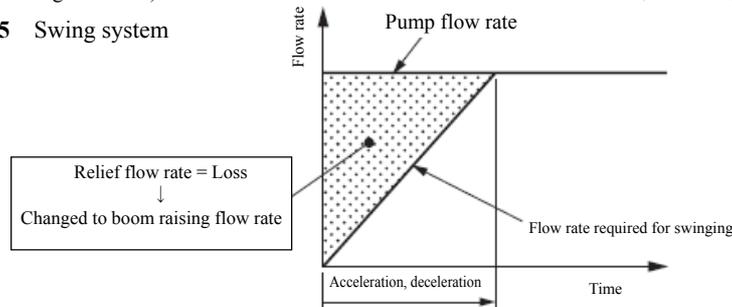


Fig. 6 Reduction in hydraulic pressure loss by swing priority system

2) On-demand power drive system

A mere reduction in hydraulic pressure losses is consumed by the work rate and fuel consumption itself is not reduced. The newly developed engine control system curbs engine output proportional to the reduction in addition by a reduction in hydraulic pressure losses, thereby reducing fuel consumption.

The PC2000-8 uses more than one engine curve in accordance with the operation pattern to use different matching points and accomplishes low fuel consumption. (Fig. 4)

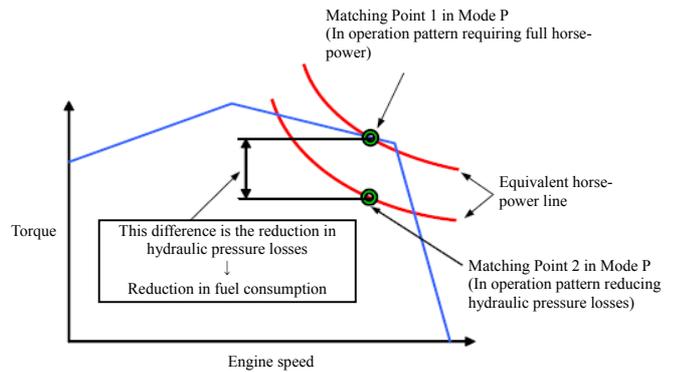


Fig. 4 Matching of PC2000-8

3) Reduction in hydraulic pressure losses by swing priority system

The independent swing hydraulic system has been changed to the swing priority hydraulic system and losses are reduced by utilizing swing acceleration relief losses during boom raising and combined operation to boom raising. (Figs. 5 and 6)

4) Effective utilization of engine output by electronically controlled variable speed fan

The cooling fan rotational speed is optimally controlled in accordance with the temperatures of cooling water and hydraulic oil. When the temperature of hydraulic oil is low, the fan rotational speed is curbed to a low rotational speed, lowering the horsepower to drive the fan and prevent wasteful fuel consumption. (Fig. 7)

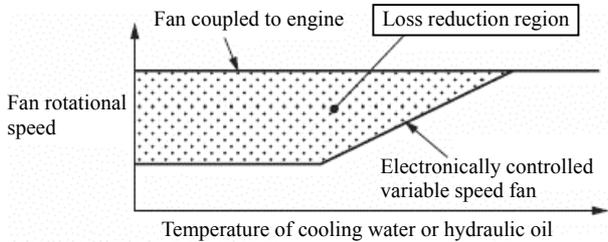


Fig. 7 Loss reduction through fan rotation control

3.2 “Environment” - Clean engine and low noise

1) SAA12V140 engine

(1) Tier-2 exhausted gas regulation of US EPA met

The PC2000-8 is installed with an SAA12V140E-3 engine. The engine is the 12V140 engine that has been proven viable through its performance in HD785, D475A and models installed with an electronically controlled high-pressure fuel injection system, to meet the Tier-2 exhausted gas regulation of the US EPA and to enhance fuel consumption, noise reduction and other engine performance. (Fig. 8)

(2) Fewer parts through large equipment size and simple structure

The time required for checking and maintenance servicing is reduced by installing only one engine, by enlarging the hydraulic pump and by simplifying the hydraulic circuits. A drastic reduction in the number of parts has reduced the work-hours required for overhaul servicing, greatly contributing to cost reduction. (Fig. 9)

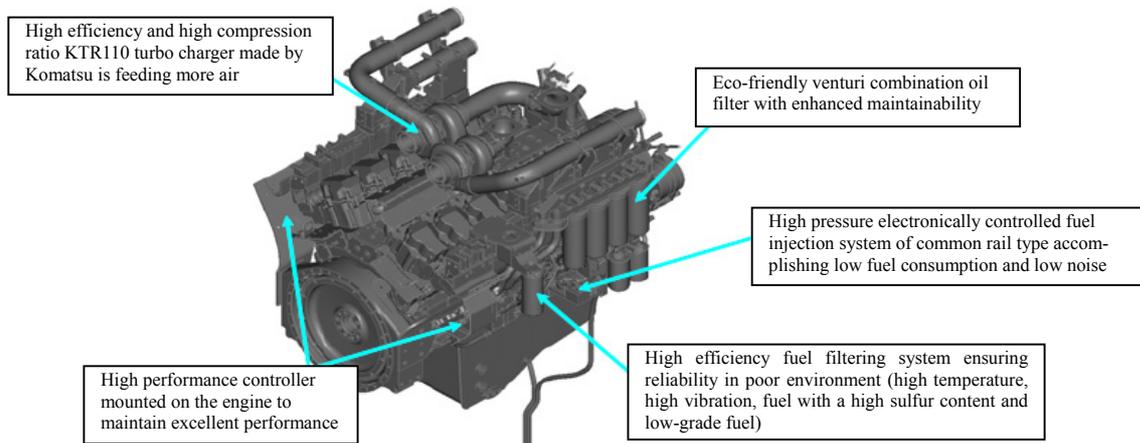


Fig. 8 Eco friendly items of new engine

(The output division for US EPA regulations changes as the number of engines is reduced to one and the regulatory value is Tier2 as in 1800-6. The exhausted gas regulations of Japan and Europe are not applicable.)

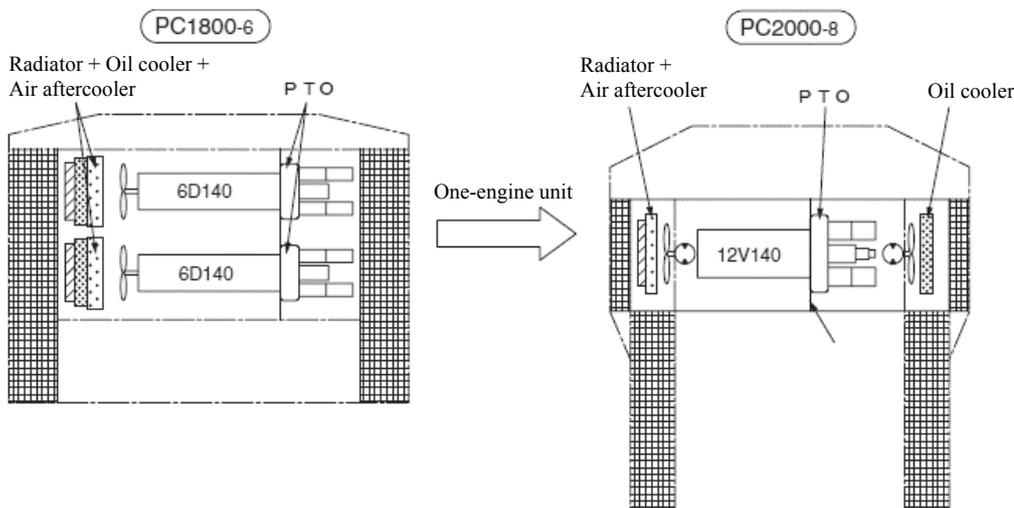


Fig. 9 Layout of engine compartment

2) Low noise

Noise reduced by 8dB (A) compared with existing machines through the following means. (Figs. 10 and 11)

- (1) Noise source sealed by a power container
- (2) Noise absorption braid installed in air intake and exhaust ports
- (3) Fan rotational speed electronically controlled
- (4) A large hybrid fan installed



Fig. 10 Power container

Item	Model		Komatsu PC2000-8	Komatsu PC1800-6
	Exterior noise	Dynamic	dB(A)	108
noise STD	Ambient 15m (No load)	dB(A)	69.4	81.6
	Ambient 15m (Relief)	dB(A)	76.8	82.8
Fan	Fan diameter	mm	Hybrid 1450 dia.	Sheeting 1280 dia.
	Electronic control	—	Provided	Not provided
	Power container	—	Provided	Not provided
	Noise absorption braid	—	Provided	Not provided

Fig. 11 Exterior noise

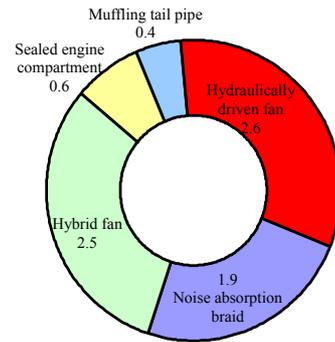


Fig. 12 Factors contributing to low noise
Breakdown of noise reduction by 8dB (A) in dB (A)



Fig. 13 Safety features of PC2000

3.3 “Safety” - Safety design and comfortable cab

1) Safety design

Thorough consideration is given to safety. The global safety design meets the safety standards of Japan, the United States and Europe. (Fig. 13)

The most stringent safety standards in the world are met entirely.

2) Comfortable cab

(1) Large cab special for mining excavators

A high-rigidity cab with a frame structure that integrates the floor has been developed, featuring excellent visibility, quietness and comfortability. The features include a roomy space allowing several adults to enter, an operator seat and space around it providing ample room even for a physically large operator, and an upgraded assistant operator seat with a retractable seat belt installed as a standard provision.

The rear storage compartment contains a first-aid kit box, a fire extinguisher is provided near the entrance and all windows have Roll-up blinds as a standard provision. The control panel contains a large 7” liquid crystal monitor as a standard provision. (Fig. 14)

3.4 “IT” - Large monitor and VHMS

1) Large, easy-to-see-and-use 7” monitor TFT (thin film transistor) liquid crystal monitor

A large, easy-to-see-and-use 7” monitor TFT liquid crystal monitor is installed as a standard provision for safe, correct and smooth operation. A high resolution panel that is not

affected by the viewing angle or brightness greatly enhances the visibility. The switches have a simple design and are extremely easy to operate, allowing one-touch operation of a power change or a lift force change. The function switches ensure easy operation of multiple functions. (Fig. 15)



Fig. 15 Large multi-monitor display (VHMS embedded)

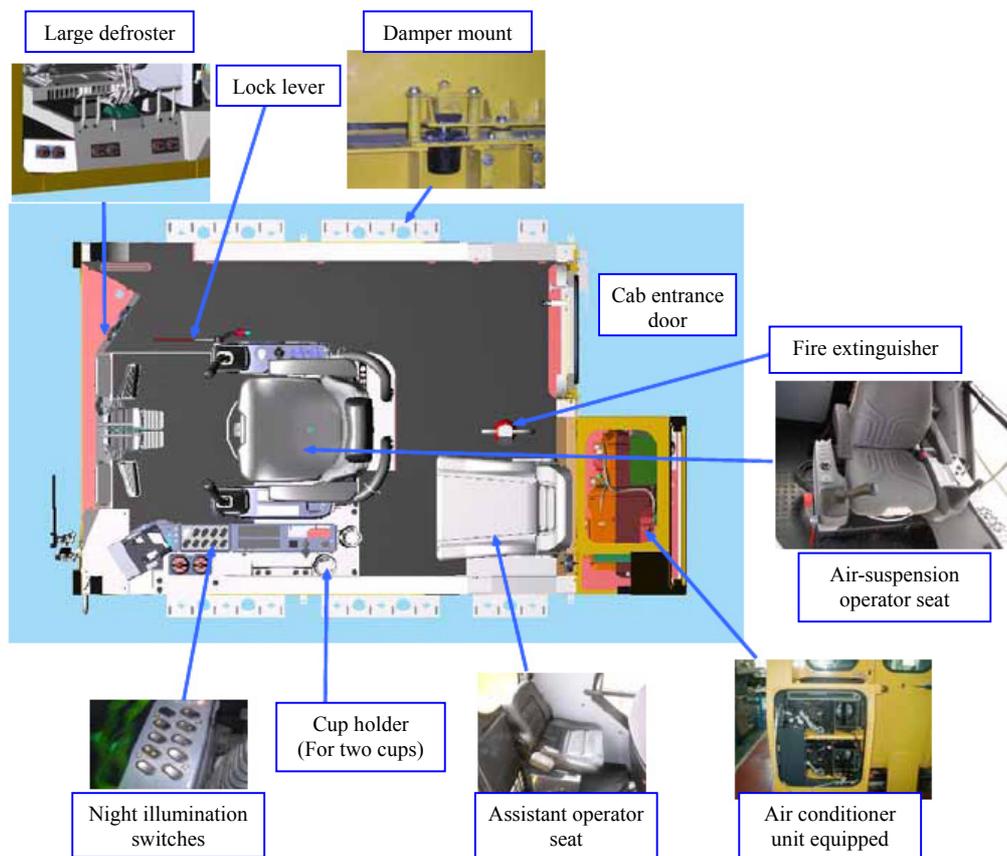


Fig. 14 Equipment around operator seat in PC2000

- 2) Vehicle Health Monitoring System (VHMS) greatly cuts vehicle maintenance cost

VHMS monitors the operation statuses of the vehicle and major components real time and displays temperatures, pressures, rotational speeds and other parameters on the multi-monitor display. Correct maintenance servicing of the vehicle through the multi-monitor display shortens the vehicle maintenance time. This, coupled with a failure diagnosis function through the storage of past data required for field service personnel, shortens the time needed for servicing.

4. Conclusion

Beginning with the change from dual engines to a single engine, new technologies have been incorporated with almost all equipment and components installed in the machine such as PTO (Power Take-Off), cooling system, fuel tank structure, reinforced undercarriage, operator cab for mining operations, power container, hydraulic equipment and electronic control system and bucket. The new model has been developed with a great zeal for completeness so that new changing of models will become unnecessary in the next ten years.

Nearly a quarter of a century has passed since the PC1500-1 was introduced into the market in 1982 as the world's first construction machinery installed with a micro computer like D555. The capacity of Komatsu's largest hydraulic excavator PC400 at that time has been increased as much as four times during this period. The development team did its best, but undue strains on the machines had been caused, creating many problems for the users and dealers.

Against this backdrop, the PC-1600-1 was developed with the determination to re-win the confidence of the users and dealers. The machine received a high reputation in mining and other applications. Since then, modification continued until PC-1800-6 without changing the basic specification. Exhausted gas regulations, however, necessitated another change in the basic specification and the PC-2000-8 has been completed as a changing of models to meet the latest regulation requirements.

Introduction of the writers



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[A few words from the writers]

Accumulated knowledge and experiences have been devoted to the development work for the model and the writers are fairly confident that the best machine has been developed. Modestly accepting market evaluation of the PC2000-8 as a mining excavator, further efforts and improvement will be made in response to market demands.