

## Introduction of Product

# Introduction of Compact Wheel Loaders WA200-6, WA270-6 and WA320-6

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*WA200-6, WA270-6 and WA320-6 have been developed in model changes to meet the Tier3 exhaust gas regulations for compact wheel loaders. New technologies and outline of the improvements in the new models are introduced.*

**Key Words:** *WA200-6, WA270-6, WA320-6, wheel loader, EPA Tier3 exhaust gas regulation, EU StageIII exhaust gas regulation, HST, traction control system, automatic reverse-rotation cooling fan*

## 1. Introduction

The conventional models WA200-5, WA270-5 and WA320-5 were introduced to the market in 2003 as the first wheel loaders that equipped an electronically controlled hydrostatic transmission (HST) for the first time for this class of machines. Since their introduction in the market, the models have enjoyed a high reputation all over the world.

Komatsu has further refined the electronically controlled HST and has developed and sold new wheel loaders WA200-6, WA270-6 and WA320-6 to be compliant with the new HST and meet the Tier3 exhaust gas regulation enforced at the beginning of 2007. The new models are overviewed (Fig. 1).

## 2. Development Objective

An emphasis was placed on the following to realize “environment,” “workability” and “reliability.”

- (1) Compliance with exhaust gas regulations of Japan, the United States and Europe to be enforced at the beginning of 2007.
- (2) Further refinement of the electronically controlled HST unique to Komatsu and further enhancement of workability.
- (3) Realization of low noise type, short engine warm-up time and longer radiator cleaning interval through a variable automatic reverse-rotation cooling fan system.
- (4) Enhancement of comfortability through a cab which shares the same concept as that for medium size wheel loaders.



Fig. 1 Full view of WA270-6

### 3. Principal Features

The principal features incorporated in the new models are described.

#### 3.1 New engine technology “ecot3” (ecology & economy technology 3) (Fig. 2)

##### 1) Compliance of Tier3 exhaust gas regulation

A common-rail electronically controlled engine has been mounted, the Tier3 exhaust gas regulation value has been met and fuel consumption has been improved.

The conventional 5 series were used to adopt the SAA6D102 engine. The WA270-6 and WA320-6 adopt the SAA6D107 engine equipped in the medium-size machines WA380-6 and PC200-8, while the WA200-6 adopts the SAA4D107 engine equipped in the PC160LC-7E0.

##### 2) Automatic engine warm-up

Detecting the engine coolant temperature of water and oil, the engine low idling rotating speed is increased to shorten the engine warm-up time.

An increase in engine rotating speed is canceled automatically when the forward-reverse lever is operated during automatic engine warm-up, to prevent HST creep run.

The engine low idling rotations are controlled by information of the engine controller and HST controller through Comnet communication.

##### 3) Automatic correction of fuel injection amount in high-altitude work

The atmospheric pressure is detected by an atmospheric pressure sensor of the engine during operation at a high altitude and the engine controller automatically corrects the fuel injection amount, to prevent lowering of the output due to low atmospheric pressure.

#### 3.2 Refined electronically controlled HST (STARE II-HST)

##### 1) Variable traction control system

The traction control system that has been adopted in the existing machines to improve the work efficiency and to reduce tire slippage during loading has been refined further. The refined system can set three levels of the maximum towing force (only one level with conventional models) while traction control is on, thereby allowing an optimum towing force commensurate with loaded loads and road surface conditions (Figs. 3 and 4).

The machine workability has been enhanced minutely compared with the conventional models such as improving the towing force during HST stalling.

<Traction control system>

A system unique to Komatsu that has been developed to improve work losses while loading products and tire wear and damage caused by tire slippage during excessive bucket pushing by curbing the maximum towing force through HST motor control while the loader is running at a low speed.

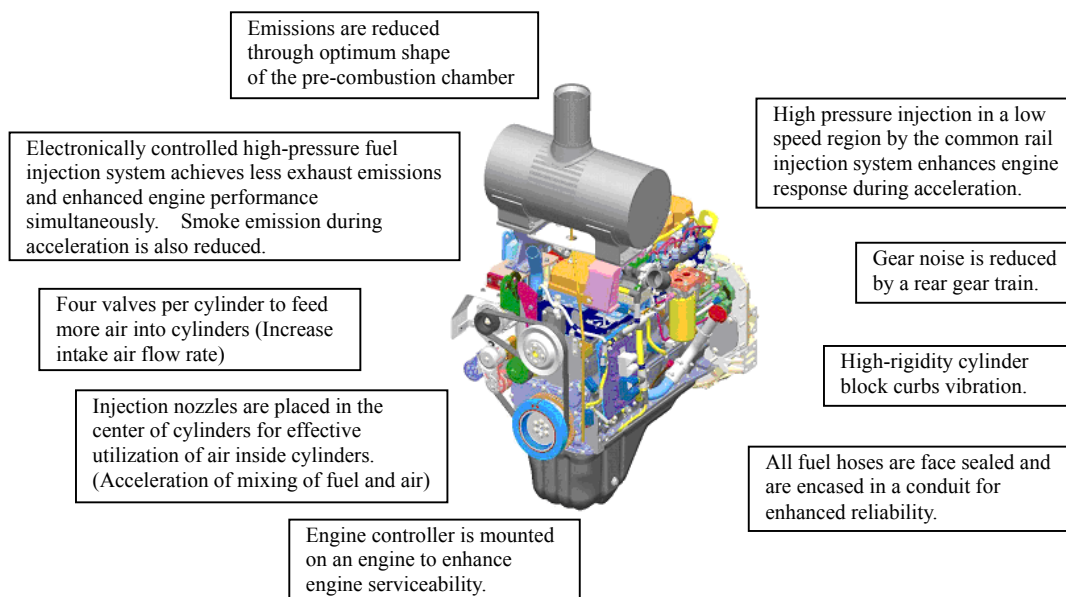


Fig. 2 Technologies incorporated in engine

2) Addition of Mode S

Mode S (standing for “Snow,” “Sand,” “Slip” and “Smooth”) for control of the towing force on a slippery road has been added to the traction control system.

This mode curbs radical slipping on a slippery road by controlling the engine speed and HST motor while the loader is running at a low speed. Small wheel loaders especially are used on snow removing machines and this function will be effective in reducing tire slipping during snow plowing.

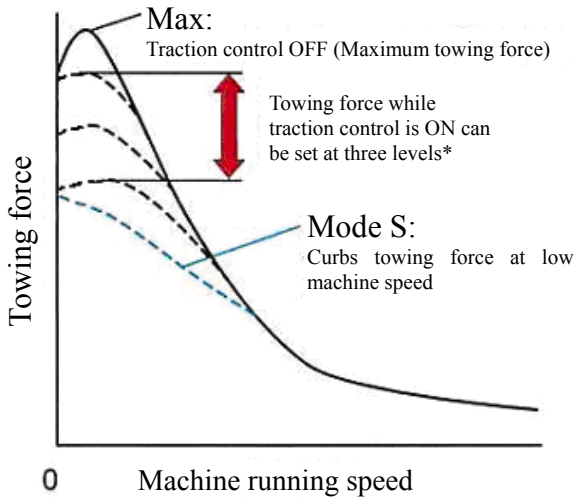


Fig. 3 Towing force in traction control

	Switch position	Mark on switch	Indicati on on monitor	Traction level selection	Feature		
					Towing force	Loaded load	Road surface conditions
Traction control OFF	(a)	MAX	None	---	Large	Suitable for heavy load	Suitable for less slippery road
Traction control ON	(b)			A	↕	↕	↕
				B			
				C			
S Mode	(c)			---	Optimum driving force can be yielded on slippery road such as in snowplowing, assuring easy work with less tire slippage.		

Fig. 4 Operating conditions for traction control

3) Max. traction switch

Max. traction switch is located on the work equipment control lever. When the traction control switch is at the ON position or S-mode is selected, pushing this switch cancels the setting of the traction control temporarily and increases the tractive effort to its 100% value. This switch is useful for operations such as piling up work where large tractive effort is required temporarily.



Fig. 5 Right console at operator's seat

In Fig. 5, ④ is the max. traction switch and ③, the traction control switch.

4) Accelerator work sensitive HST control

Minutely-thought-out HST control in accordance with the pressing level of the accelerator pedal using a newly-developed angle sensor of the electric accelerator pedal reduces shocks during acceleration or deceleration, ensuring smoother running and energy-saving operation (Fig. 6).

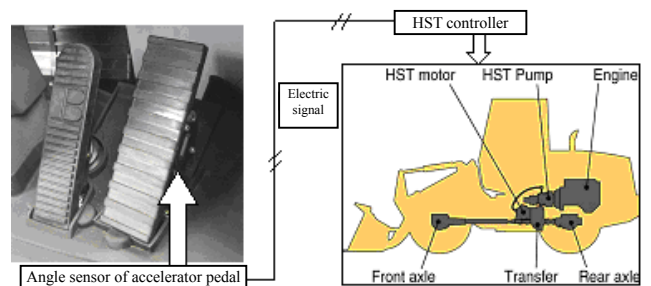


Fig. 6

### 3.3 Variable automatic reverse-rotation cooling fan system

#### 1) Variable-speed cooling fan

The fan rotating speed is automatically controlled in accordance with the engine coolant temperature of water, HST oil temperature and engine boost temperature to shorten the engine warm-up time in winter, enhance the heater performance and to reduce fan noise (Fig. 7).

- When the outside air temperature is low, a minimum fan rotating speed (low rotating speed, but enough for preventing danger of fan shutdown) is maintained to shorten the engine warm-up time and to enhance heater performance. The fan rotating speed is increased as the various sensing temperatures increase.
- The fan rotating speed to secure an air flow rate to cool the air conditioner capacitor (MID) is maintained after engine warm-up. The fan rotating speed is increased as the various sensing temperatures increase.
- The maximum fan rotating speed is the speed at which a heat balance is maintained as the various sensing temperatures increase. A built-in type flow control valve is adopted in the fan motor to prevent the fan rotating speed from lowering when the fan motor oil temperature rises.

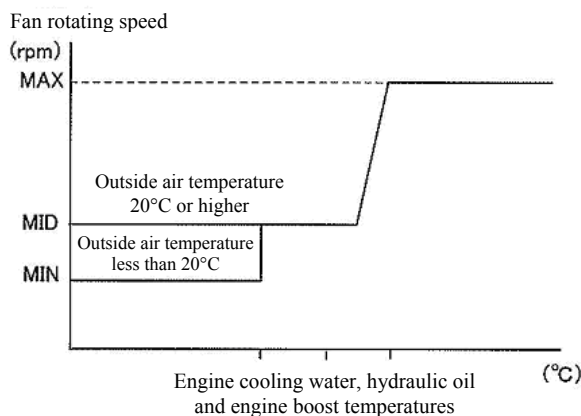


Fig. 7 Fan rotating speed

#### 2) Automatic reverse-rotation cooling fan system

The automatic reverse-rotation cooling fan system already adopted in medium wheel loaders is now installed in small-sized vehicles also as a standard specification (Fig. 8). The system blows off dust and rubbish attached to the radiator, after-cooler and hydraulic oil cooler by operating the fan reverse-operation switch provided in the cab to rotate the hydraulic drive fan backward. The system prolongs intervals of cleaning for removing wood chips, grass, and other light loads that clog the radiator at work sites and simplifies cleaning work.

The reverse-rotation fan switch can switch to the manual reverse-rotation mode and automatic reverse-rotation mode. In the automatic reverse-rotation mode, the fan automatically rotates in reverse between the interval time and re-

verse-operation continuation time set by a timer, thereby prolonging the cleaning interval. The automatic reverse-rotation interval time and reverse-operation continuation time can be changed by the monitor service mode, allowing adjustment in accordance with the market usage.

The manual reverse-rotation fan switch is located in ⑤ in Fig. 5.

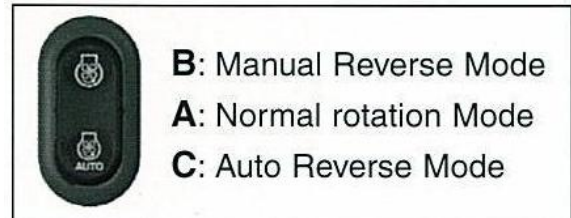


Fig. 8 Reverse-rotation fan switch

### 3.4 Large integral ROPS (Roll-over Protective Structure) cab

#### 1) Air conditioner unit arranged on front side

The air conditioner unit is adopted on the front side in the small-sized vehicles also as in medium size wheel loaders.

- In the conventional wheel loaders, the pipe from the air conditioner unit in the rear of the cab to the air outlet in the dashboard through the duct under the floor is required. By eliminating the duct, heat loss and ventilation resistance can be reduced.
- The space behind the seat can be wider, providing a roomy space for an operator of large physique. The sliding distance behind the seat is increased 50mm.
- The outside air filter is arranged below the left door for easy access from the ground and for improved maintainability. The inside air filter is also arranged in the left front of the cab, allowing easy replacement (Fig. 9).



Fig. 9 Inside and outside air filters



## 2) Large laminated safety glass in front window

For safety consideration, laminated glass is adopted in the front window for wheel loaders shipped to all destinations (**Fig. 10**).

As options, front laminated glass embedded with heat wire and a heat wire timer are installed for snow-plowing vehicles.

Glass embedded with heat wire is installed in the rear window as a standard specification.



**Fig. 10** Large pillarless front glass

## 3.5 “ECO” indicator

The “ECO” indicator that assists eco friendly energy-saving operation is installed in the main monitor (**Fig. 11**).

A green indicator lights up during energy-saving operation with less CO<sub>2</sub> emissions and a high fuel consumption efficiency, urging the operator to promote energy-saving operation.



**Fig. 11** “ECO” indicator

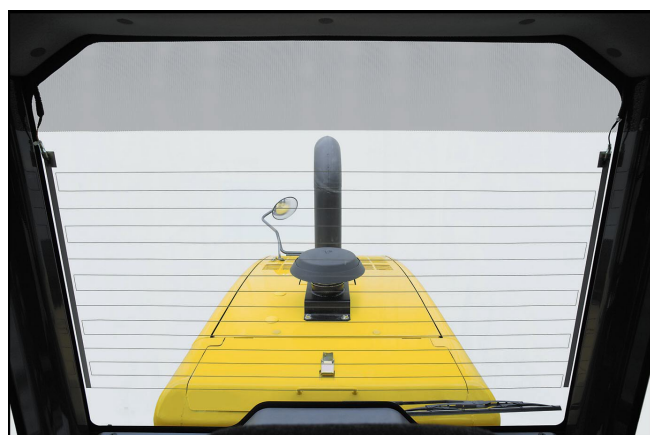
## 3.6 KOMTRAX2 installed as standard equipment

Information to support energy-saving operation including data such as load frequency of HST traveling bearing stress and frequency of ECO indicator lighting has been added to KOMTRAX2 which is installed in conventional models also as a standard specification.

## 3.7 Improved rear visibility by changing layout of air inlet and outlet ports

In the conventional models, an air inlet extension and exhaust pipe are placed in the left and right of the top plate of the engine hood. In the new models, the air inlet and outlet ports are placed longitudinally in the center of the top plate of the engine hood to improve the rear visibility when checking the rear (**Fig. 12**).

Also, to check rear obstacles, rear downward view mirror is installed as standard equipped to improve safety confirmation.



**Fig. 12** Rear visibility

## 4. Conclusion

The conventional models enjoyed high evaluation inside and outside of Japan for high work efficiency and low fuel consumption as machines that mounted the electronically controlled HST for the first time for their class. The recent development aimed at further upgrading the electronically controlled HST in addition to meeting the Tier3 exhaust gas regulation. The objective was accomplished by creating controller software for the HST system in-house. The in-house software achieved improvement and evolution over and above the control performance of the conventional models.

It is expected that the advanced electronically controlled HST in the new model series will win higher evaluation of the users.

### Introduction to the writers



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### [A few words from the authors]

The recent development involved the development of three models, namely, WA270-6, WA200-6 and WA320-6, concurrently. The WA200-6 and WA270-6 were developed by the Construction Equipment Technical Center 2, Corporate Development Division, while the WA320-6 was developed in Germany (European Development Center). The Construction Equipment Technical Center 2 later took over the development work of WA320-6 as well and the team members in Japan were kept extremely busy. However, no compromise was made in verifying quality and the work to develop the new models could be completed smoothly beginning October 2007 as scheduled through the cooperation of the related organizations.

The sales of new models have started in Japan and in the United States. It is hoped that the technological power of Komatsu will be evaluated highly throughout the world.