

Introduction of Products

Large-size Wheel Loader WA900-8/8E0/8R

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The new WA900-8/8E0/8R wheel loader models have been developed around the underlying concepts of “the environment,” “safety” and “ICT,” a full model change from the previous versions, and put on the market. Some of the key features of the beefed-up new models will be presented in this report.

Key Words: wheel loader, WA900-8/8E0/8R, Tier 4 Final, environment, safety, ICT, semi-automatic, machine vicinity monitoring

1. Introduction

For more than ten years since they were launched in 2007, the previous wheel loader models have been favorably received by numerous users across the markets. During that period, however, user requirements have changed and competing machines have gained greater customer appeal. To respond to those changes, the newly developed WA900-8/8E0/8R models have gone through a full model change, incorporating the latest relevant technologies. The new models for Europe and North America comply with EPA Tier 4 Final / EU Stage V emissions regulations respectively, the details of which will also be discussed in this report. The WA900-8 is for North America, the WA900-8E0 is for Europe and the WA900-8R is for the rest of the world.



Fig. 1 The currently developed machine model

2. Aims of Development

The new models were developed as large-size wheel loaders with easy operation and low production cost built on the “quality and reliability” acquired over the years on the previous models. The new technologies incorporated on the new models have been developed to achieve higher levels of “environmental,” “safety” and “information and communication technology (ICT)” performance, offering improved fuel economy, higher production and enhanced safety and thereby substantially increasing customer appeal. All this is summarized below.

- (1) Improved environmental measures and economic efficiency
 - 1) EPA Tier 4 Final / EU Stage V emissions regulations compliant engines
 - 2) Minimized losses and improved fuel economy
 - 3) Reduced tire wear, eliminated cuts in the tire
- (2) Productivity improvement
 - 1) New bucket profile for improved digging efficiency
 - 2) Powerful and smooth digging
 - 3) Smooth approach for dump

- (3) Improved safety and comfort
 - 1) Safe daily maintenance
 - 2) Comfortable cab reducing operator fatigue
 - 3) Semi-automatic functions supporting the operator
 - 4) Stability maintained while driving on rough road surfaces
 - 5) Machine vicinity monitoring system for safety support
- (4) Enhanced maintainability and reliability
 - 1) Higher durability of powertrain components
 - 2) Improved radiator repairability and maintainability
 - 3) Centralized oil sampling point
- (5) Adoption of ICT technology
 - 1) Color LCD monitor with good nighttime visibility
 - 2) ECO guidance to support fuel consumption reduction
 - 3) KOMTRAX Plus to help with machine monitoring

3. Major features

3.1 Improved environmental measures and economic efficiency

3.1.1 EPA Tier 4 Final / EU Stage V emissions regulations compliant engines

The engine and exhaust aftertreatment technologies that are incorporated on the new models for Europe and North America to comply with EPA Tier 4 Final / EU Stage V emissions regulations are presented below. The engines mounted on the new models for the rest of the world are not equipped with exhaust aftertreatment devices and have the emission level equivalent to the Tier 2 emissions regulations.

(1) Komatsu Diesel Particulate Filter (KDPF)

The engines are equipped with a KDPF, which traps at least 90% of the particulate matter (PM) in the exhaust gas. The KDPF consists of an oxidation catalyst and a catalyzed soot filter, which is made of ceramics and traps PM, allowing only purified exhaust gas into the atmosphere. The trapped amount of PM is measured by a sensor and based on the measurement, the engine management increases the temperature within the KDPF, activating the oxidation catalyst for automatic burning and purification of PM.

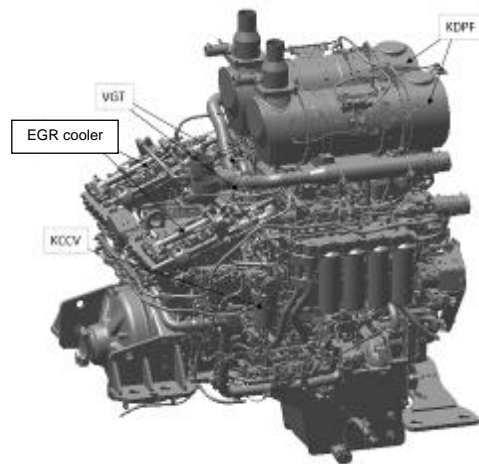


Fig. 2 SAA12V140E-7

(2) Variable Geometry Turbocharger (VGT)

A variable geometry turbocharger is used on the new engines to enable exhaust gas recirculation across a wide operating range to achieve both reduced NOx and improved fuel economy. The turbocharger is hydraulically driven for high reliability.

(3) Cooled EGR system

To substantially reduce NOx, it is important to sufficiently cool a high volume of recirculating exhaust gas. Therefore, the EGR cooler features a flat tube and inner fins. The system also features a highly accurate and reliable hydraulic servo EGR valve.

(4) Komatsu Closed Crankcase Ventilation (KCCV)

The KCCV system removes oil from blow-by gas, sending the purified gas into the air intake system while returning the oil back to the engine oil pan.

(5) Combustion system

Reduction in the PM quantity and improvement in the fuel economy performance were achieved together by introducing an electronic control common rail injection system with a maximum injection pressure of 200 MPa and a new combustion chamber.

(6) Electronic control system

The electronic control system employs a newly developed engine control unit, offering highly accurate and optimum control of the electronically controlled common rail fuel injection system, VGT and KDPF. In addition, the sophisticated control system offers more advanced machine diagnostics.

(7) Engine compartment heat discharge duct

The engine compartment cover is equipped with a duct to efficiently discharge heat from the engine and exhaust aftertreatment system with a radiator fan. This has substantially reduced the size of the heat discharge opening on the cover, eliminated the overheating of the components in the compartment and reduced the ambient noise from the engine.

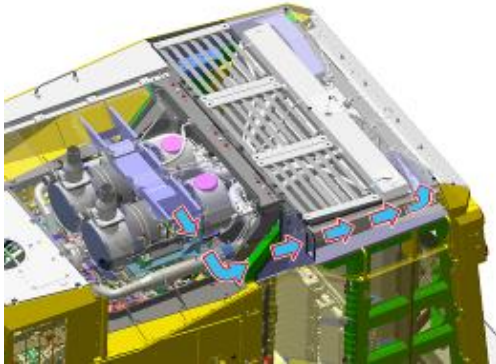


Fig. 3 Engine compartment heat discharge duct

3.1.2 Minimized losses and improved fuel economy

(1) Reduced losses in the steering and work equipment hydraulic circuits

A load sensing hydraulic system with a variable displacement piston pump has been introduced to the steering and work equipment circuits, minimizing hydraulic pressure loss through machine status-based optimum control.

(2) Hydraulically driven radiator cooling fan

The radiator cooling fan, which previously was driven directly by a belt, is now driven hydraulically. The fan speed is optimally controlled, reducing power loss caused by an excess of fan speed. In addition, the fan can run in reverse to blow foreign material off the radiator core.



Fig. 4 Hydraulically driven fan

(3) Equipped with “Komatsu SmartLoader Logic”

The new models are armed with “Komatsu SmartLoader Logic”, an engine control system, which determines the machine status based on inputs from sensors mounted across the machine and commands engine torque appropriate for the situation to optimize fuel efficiency. This helps maximize the mechanical potential of the load sensing hydraulic system with substantially reduced fuel consumption. A Komatsu digging/loading test (in v-cycle operation) showed a 10% reduction in hourly fuel consumption over the previous models.

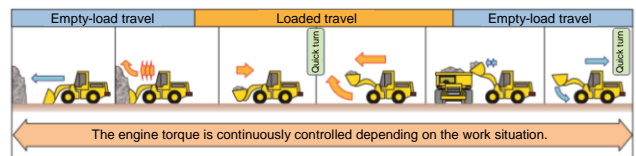


Fig. 5 Komatsu SmartLoader Logic

3.1.3 Reduced tire wear, eliminated cuts in the tire

(1) Tire slip control

As soon as the front wheels start slipping during digging work, this is detected by sensors, which send signals so that the transmission clutches and therefore traction to the tires are optimally controlled to minimize slip and tire wear.

(2) Large tire guard

The large tire guards on the sides of the bucket divert large boulders away from the tires during digging work, protecting the tires from cuts and helping to extend tire life.



Fig. 6 Large tire guard

3.2 Productivity improvement

3.2.1 New bucket profile for improved digging efficiency

The bucket profile has been optimally redesigned so that the material can flow more smoothly into the bucket as it is dug up. A Komatsu test showed a 4% improvement in work rate for the new bucket over the previous one with the same amount of fuel. Another test conducted among unskilled operators showed improved work rates and more consistent amounts of the load scooped up in the bucket.

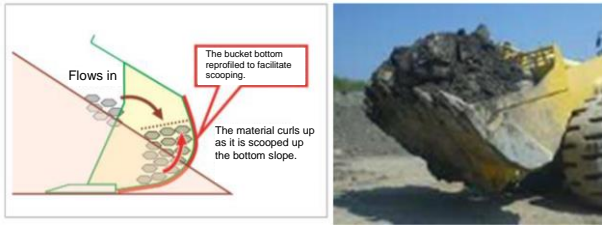


Fig. 7 New profile bucket

3.2.2 Powerful and smooth digging

The hinge pins on the loader linkage have been relocated to increase the work equipment force by 17%, enhancing digging performance, while the hydraulic oil pressure remains the same as the previous models. The high-capacity variable displacement piston pump increases work equipment speed, enabling smooth approach for dump.

3.2.3 Smooth approach for dump

The “modulated clutch” of the transmission works with the left brake pedal to enable inching operation for easier control of travel speed for more efficient, smoother approach for dump than the previous transmission cutoff system.

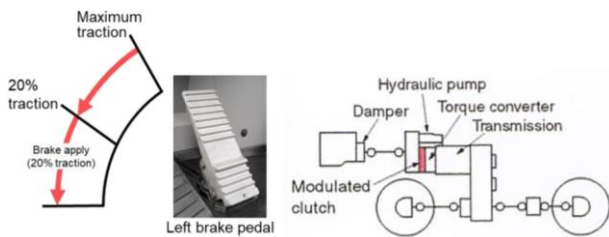


Fig. 8 Modulated clutch operated with the left brake pedal

3.3 Improved safety and comfort

3.3.1 Safe daily maintenance

The access ladders on both sides of the machine, a hydraulic power ladder and a walkway around the rear of the machine ensure safe daily inspection and maintenance.



Fig. 9 Access ladders

3.3.2 Comfortable cab reducing operator fatigue

The newly designed large cab is roomier and quieter than the previous version, offers improved vibration damping and keeps out dust more effectively to provide a comfortable operating environment. The trainer seat provides a safe and comfortable environment for operator training. The high-mount cab with the pillar-less front glass offers a wide view and improved visibility of the dump truck when loading. The steering and work equipment levers, whose positions can be adjusted to suit the operator of any size, are mounted on the operator seat, keeping their selected, best positions relative to the operator seat even when driving over rough terrain and therefore helping to minimize operator fatigue. Furthermore, the operator seat is equipped with a heater as standard for comfortable operation in low ambient temperatures.



Fig. 10 Large cab with a trainer seat

3.3.3 Semi-automatic functions supporting the operator

The “automatic digging” system enables the operator to perform excavation from the start of digging to scoop-up by only operating the accelerator pedal because, by sensing the load applied on the work equipment, the system automatically controls the work equipment. In a v-cycle operation, the “semi-automatic approach & dump system” automatically raises the work equipment as the machine approaches the dump truck and dumps the load when the “semi-automatic dump” start switch is pressed. Those semi-automatic features ensure consistent volumes of dumped load irrespective of the operator’s skill level and help improve productivity and minimize operator fatigue.

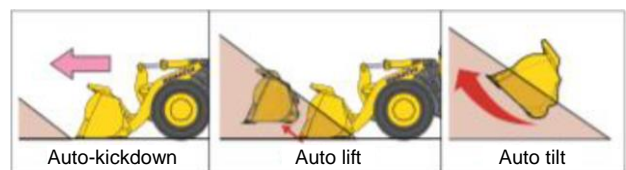


Fig. 11 Auto-excitation

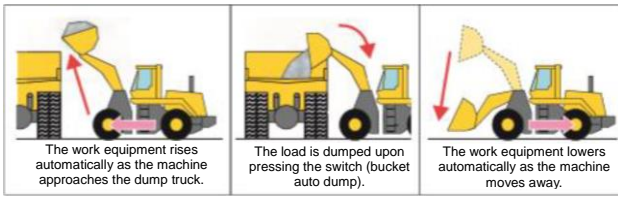


Fig. 12 Semi-automatic approach & dump

3.3.4 Stability maintained while driving on rough road surfaces

The ECSS (Electronic Control Suspension System) dampens vibration while driving over rough terrain through the ECSS valve and accumulator, maintaining machine stability, greatly reducing operator fatigue and preventing spillage of the load.

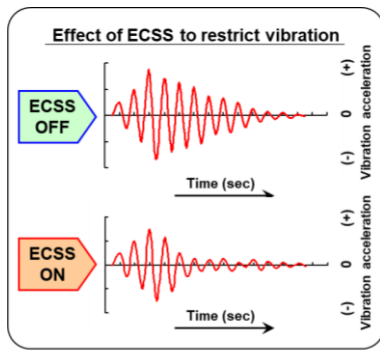
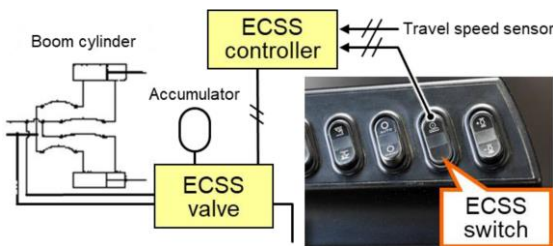


Fig. 13 ECSS damper for rough terrain driving

3.3.5 Machine vicinity monitoring system for safety support

The new models are equipped with the 5-camera, 4-radar KomVision. Those cameras and radars are mounted around the machine to enable the operator to check the vicinity of the machine on the monitor for safety. Obstacles detected by the radars are highlighted on the monitor and at the same time the buzzer sounds to prompt the operator to take collision avoidance actions. The WA900-8/8E0/8R models are the first among the wheel loader range to be equipped with KomVision, which has also been developed for dump trucks and other machines. The front camera, which is included only in KomVision for wheel loaders, enables the operator to observe the area ahead of the front tires, helping to monitor leveling operation under way and also to protect the tires from cuts by large boulders etc.

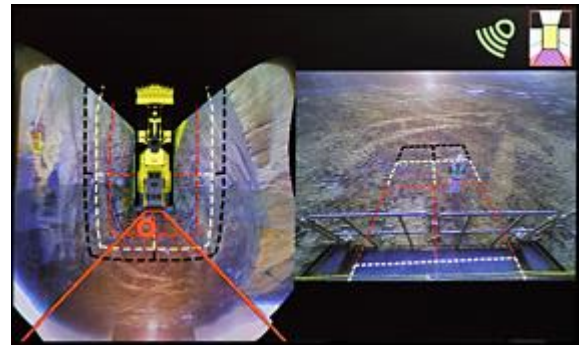


Fig. 14 KomVision, Monitoring system for circumstances



Fig. 15 Front camera

3.4 Enhanced maintainability and reliability

3.4.1 Higher durability of powertrain components

The newly designed transmissions, axles and other powertrain components offer higher durability for extended overhaul intervals. To simplify overhaul procedures, the brakes are segmented so that only the segment requiring overhaul needs to be worked on. All this contributes to reducing the number of overhauls, or downtime, and maintenance cost over the life of the machine.

3.4.2 Improved radiator repairability and maintainability

For improved serviceability, the radiator core is made up of modules so that only the module requiring repair can be taken out without removing the radiator guard. The radiator guard and grille can be opened widely to facilitate the cleaning of the radiator core and help prevent the core from clogging up and overheating.



Fig. 16 Radiator core maintenance

3.4.3 Centralized oil sampling point

The centralized service center with ports of various fluids used in the machine facilitates daily maintenance operation from the ground level such as taking oil samples and refilling the automatic greasing tank, helping to prevent failures that could lead to substantial downtime.



Fig. 17 Service center

3.5 Adoption of ICT technology

3.5.1 Color LCD monitor with good nighttime visibility

The machine monitor incorporates an advanced, high definition 7-inch LCD display with good nighttime visibility and usability. Pressing the dedicated key on the switch panel changes the LCD screen to the user menu where ECO Guidance, Machine Configurations/Settings, Aftertreatment Regeneration, Maintenance, Monitor Settings and View Messages pages can be displayed by selecting the corresponding tabs.



Fig. 18 Machine monitor with 7-inch high definition LCD unit



Fig. 19 User menu screen

When ECO Guidance is selected, Operation Records, ECO Guidance Records and Average Fuel Consumption Logs are displayed for possible selection. Those data can be used to help improve machine operation for fuel efficiency. The average fuel consumption records can be displayed as a graph for either each hour of the last 12 hours or each day of the last seven days.

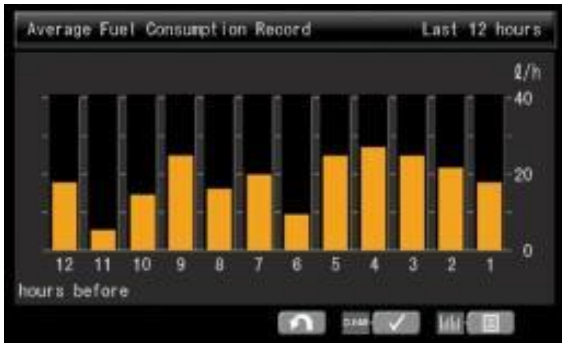


Fig. 20 Fuel consumption history display

3.5.2 ECO guidance to support fuel consumption reduction

The LCD unit now offers ECO Guidance, which displays pop-up advice in real time for fuel-efficient operation.



Fig. 21 LCD unit and ECO guidance

KOMTRAX Plus, a machine monitoring system, is also offered as standard.

3.5.3 KOMTRAX Plus to help with machine monitoring

KOMTRAX Plus supports daily machine care by displaying on the LCD the remaining hours before the next periodic maintenance, such as filter replacement, as the occasion draws near. The timing for the reminder can be set between 10 and 200 hours.

Maintenance	Interval	Remain
Air Cleaner Cleaning or Change	—	—
Engine Oil Change	500 h	500 h
Engine Oil Filter Change	500 h	500 h
Fuel Prefilter Change	500 h	500 h
T/M Oil Filter Change	500 h	500 h

Fig. 22 Maintenance time display

4. Conclusion

The new WA900-8/8E0/8R wheel loader models incorporate many new technologies to reduce production cost and enhance safety, two of the most important requirements for customers in the mining sector, and therefore we believe that those new models have substantially stronger appeal to and will receive higher ratings than the previous models from the market. We will monitor the market for feedback so that we can continue to swiftly respond to the market requirements and gain more trust among our customers.

Introduction of the authors



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[A comment from the authors]

The new WA900 models are the first full model change since the last one around 30 years back. Having overcome numerous hurdles, which took long, we finally were able to develop and launch those models. The launch started in North America and we are starting to hear words of favorable acceptance. We will monitor the market so that we can continue to satisfy our customers, and satisfy them even more at that. Our deepest appreciation to all including our development and production staff who were involved in the development of those models.