

Introduction of Products

Rigid Dump Truck HD465/605-8 and HD325/405-8

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While keeping in mind “Environment”, “Safety”, and “ICT” as the key concepts, we have developed and introduced to the markets the new rigid dump trucks HD465/605-8 and HD325/405-8, which meets the 4th emission regulations (Tier4 Final) now enforced in Japan, US, and Europe. In this report we like to introduce the features of the new products.

Key Words: Rigid dump truck, HD465/605-8, HD325/405-8, Tier4 Final, environment, safety, ICT, fuel consumption reduction, KTCS, auto idle stop

1. Introduction

Although the conventional machines have earned high praise from many users since they were introduced to the market in 2006, they have been demanded to meet the Tier4 Final emission regulation (Act on Regulation, Etc. of Emissions From Non-road Special Motor Vehicles 2014 of Japan, EPA Tier4 Final of the USA, EU Stage IV of Europe). Since 10 years have passed since the launch, we succeeded to develop succession models HD465/605-8 and HD325/405-8, which are featured with high productivity, high economic performance, improved safety and advanced design by incorporating the latest technologies, and to introduce them to the market. The outlines of these products are as follows.



Fig. 1 HD465-8



Fig. 2 HD325-8

2. Aims of Development

We made the products meet the Tier4 Final emission regulation while maintaining the quality and reliability, and also improved their product competitiveness significantly by reducing the fuel consumption, improving the productivity and safety, and utilizing ICT technology. The features are as summarized below:

- (1) Improved environmental-friendliness and economic efficiency
 - 1) Installation of new engines meeting the Tier4 Final emission regulation and aftertreatment system
 - 2) Reduced fuel consumption
 - 3) Adoption of auto idle stop function
- (2) Improved productivity
 - 1) Adoption of KTCS
- (3) Improved safety and comfort
 - 1) Improved accessibility
 - 2) Equipping a rear view monitor
 - 3) Adoption of rear combination LED lamps
 - 4) Adoption of a newly designed cab and round type dashboard
- (4) Adoption of ICT technology
 - 1) Adoption of a machine monitor with 7-inch high definition LCD unit
 - 2) ECO guidance to support fuel consumption reduction
- (5) Improved maintainability
 - 1) Ground-level access to the battery box provided
 - 2) Equipping a battery disconnect switch

3. Details of Features

This section explains the means and technologies taken to achieve the aims described in the previous section.

3.1 Improved environmental-friendliness and economic efficiency

- (1) Installation of new engines meeting the Tier4 Final emission regulation and aftertreatment system

Below is a description of the engine and aftertreatment system technologies that were incorporated in the products to satisfy the Tier4 Final emission regulation.

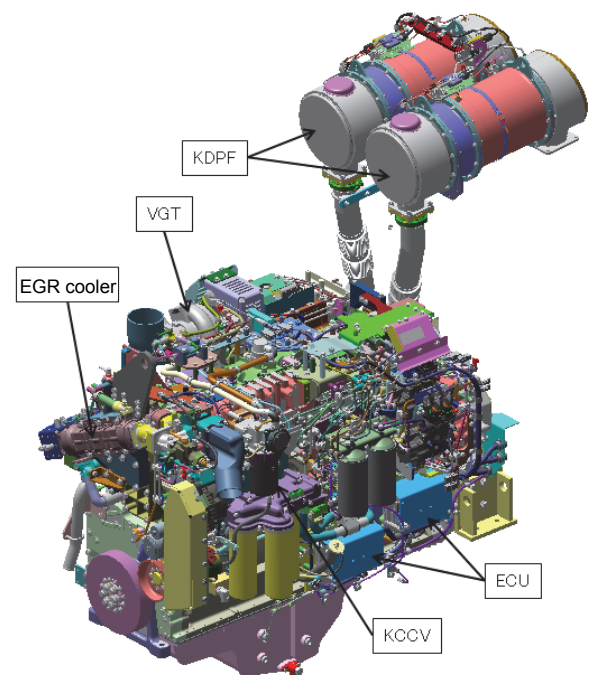


Fig. 3 HD465/605-8 SAA6D170E-7 engine

- 1) 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.

2) Cooled EGR system

To reduce the NOx quantity significantly, it is important to sufficiently decrease the temperature of the large-capacity exhaust gas recirculation gas. The EGR cooler was changed from the conventional type with multiple tubes to a new type with a flat tube and inner fins. In addition, the EGR system is equipped with an EGR valve that uses a highly accurate and reliable hydraulic servo mechanism.

3) Variable Geometry Turbocharger (VGT)

By installing a variable turbocharger, it became possible to recirculate exhaust gas in a wider operating range. This contributes to both reducing the NOx quantity and improving the fuel economy performance. For the drive system, hydraulic driving was adopted for its high reliability.

4) Komatsu Closed Crankcase Ventilation (KCCV)

The KCCV is installed to remove the oil contained in the blowby gas. After the oil contained in the blowby gas is separated by the KCCV, the purified exhaust gas returns to the air intake and the separated oil returns to the engine oil pan.

5) Komatsu Diesel Particulate Filter (KDPF)

The new products are equipped with KDPF to capture particulate matter (PM) contained in the exhaust gas. On the HD465/605-8, two 12-inch diameter KDPF are installed. On the HD325/405-8, one 14-inch diameter KDPF is installed.

6) Urea Selective Catalytic Reduction (SCR) system

The HD325/405-8 is equipped with a Urea SCR system, which reduces the NOx quantity contained in the exhaust gas to one-fifth or less.

The system sprays urea aqueous solution into the exhaust gas. The ammonia formed from the urea solution reacts with the NOx in the SCR catalyst to decompose the NOx into harmless nitrogen (N₂) and water (H₂O). The urea SCR system is roughly divided into (1) the urea aqueous solution supply system, which sprays urea solution into the exhaust gas, (2) the urea solution mixing pipe, which decomposes the injected urea solution into ammonia and disperses it in the exhaust gas, and (3) the SCR assembly, which contains an SCR catalyst that promotes the NOx decomposition reaction. The urea aqueous solution supply system consists of a urea solution tank, urea solution pump, and urea solution injector. The urea solution tank is placed behind the fuel tank to make it easily accessible.

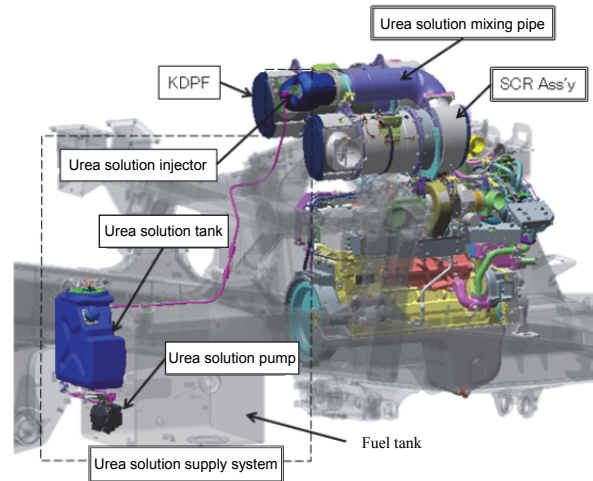


Fig. 4 Urea selective catalytic reduction system (HD325/405-8)

7) Electronic control system

A newly developed engine control unit was introduced for the electronic control system, to enable optimum control of the electronic control common rail injection system, VGT, KDPF, and urea SCR system with high accuracy. In addition, the fault diagnostic system has been further sophisticated by introducing an advanced control system.

(2) Reduced fuel consumption

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

A variable piston pump was newly introduced for the steering and work equipment hydraulic circuits.

Losses in oil pressure are reduced by optimal control of the pressure in accordance with the machine's operating conditions.

2) Variable transmission main relief pressure

Losses in oil pressure are reduced by switching the main relief pressure to low in gear speeds which require low clutch holding pressure.

3) Split transmission charge pump

The charge pump was split into two segments, so that the oil from one segment can bypass the main relief valve and flow to the torque converter when the main pressure can be maintained by the other segment only (HD465/605 only). The switching works according to the engine speed preset for each gear speed.

4) Adoption of a hydraulic drive fan

The radiator cooling fan was changed from the conventional direct belt driven fan to a hydraulic driven fan. The fan speed control has been optimized to reduce losses in horsepower due to unnecessary fan driving.

In addition, the fan can operate in reverse direction to blow away foreign material clogged in the radiator core.

5) Engine gross output control

Engine gross output control was introduced to control the engine gross output according to the fan driving force and keep the net output constant (HD465/605 only). The fuel consumption is reduced by controlling the gross output according to the fan rotating speed.

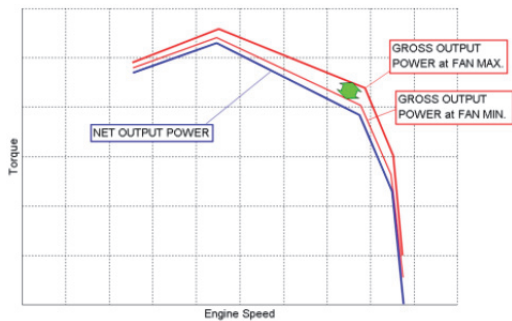


Fig. 5 Conceptual diagram of engine dynamic torque control

(3) Adoption of auto idle stop function

The auto idle stop function was introduced to automatically stop the engine when the idling time continues for a preset time, for example, during a wait for loading.

When the idling time reaches 30 seconds before the preset time, the monitor changes to the countdown screen and announces that the engine is about to stop. Automatically stopping the engine at the preset time reduces unnecessary fuel consumption.

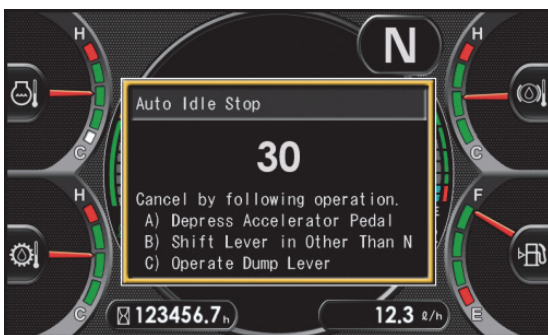


Fig. 6 Adoption of auto idle stop count down

3.2 Improved productivity

(1) Adoption of the Komatsu Traction Control System (KTCS)

The KTCS continually calculates the rear tire slip rate from the travel speed and the wheel speed. If a tire slips on the surface of soft ground or the like, the slip ratio of the tire is controlled by individually braking the slipping tire.

By maintaining the tire traction optimally, a traveling performance higher than the conventional automatic spin regulator (ASR) can be attained, resulting in improved productivity and tire life.

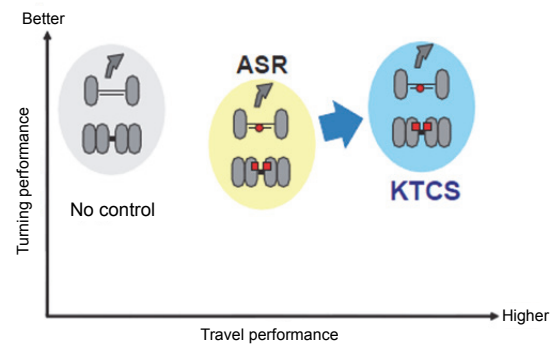


Fig. 7 Features of KTCS

3.3 Improved safety and comfort

(1) Improved accessibility

The ladder provided on conventional models for access to the operator's seat has been changed to stairs for more safety and ease of ascending/descending. In addition, a guard was added on the engine hood. Pin spike type walkways are provided to prevent degradation of the slip-proof function due to aged deterioration or accumulation of dirt.

(2) Equipping rear view monitor

A rear view camera and a color LCD monitor are equipped as standard. The display can be switched between the continuous display mode and the active only in reverse position mode. During backward travel, the monitor supports the operator by displaying guidelines.



Fig. 8 Monitor screen and rear view camera

(3) Adoption of rear combination LED lamps
LED lamps were introduced for the rear combination lamp to improve the visibility.

(4) Adoption of a newly designed cab and round type dashboard

ROPS and FOPS integrated cabs have been newly designed. Round type dashboards were introduced to attain higher operability based on human engineering.

Switches and controls are arranged at locations easy for the operator to reach.



Fig. 9 Round type dashboard

In addition, a seat heater is built in the operator's seat as a standard equipment to improve the comfortableness during cold weather.

3.4 Adoption of ICT technology

(1) Adoption of a machine monitor with 7-inch high definition LCD unit

A machine monitor with a 7-inch high definition liquid crystal display (LCD) unit, which is easy to view and use and is provided with high functionality, has been introduced. By operating the switch panel, the view on the LCD unit is switched to the user menu screen and tabs are displayed for each of the energy saving guidance, vehicle body setting/information, regeneration of aftertreatment system, SCR information, maintenance, monitor setting, and message display functions in an easy-to-understand manner.



Fig. 10 Machine monitor with 7-inch high definition LCD unit



Fig. 11 User menu screen

By choosing "ECO Guidance", you can view the operation records, ECO guidance records, and fuel consumption history. Utilizing the data helps improve the machine operation and the energy saving operation. The fuel consumption history can display a graph of the average fuel consumption per hour for the last 12 hours or the average fuel consumption per day for the last one week.

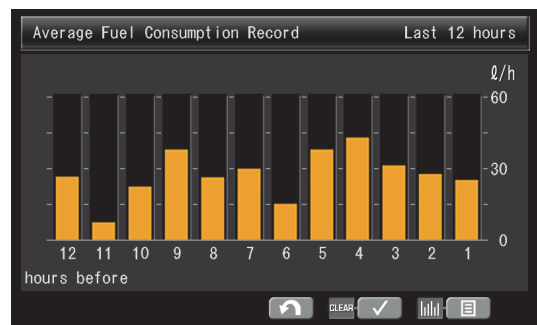


Fig. 12 Fuel consumption history display

(2) ECO guidance to support fuel consumption reduction

The ECO guidance function for energy saving operation was added. The ECO guidance provides real-time advices by pop-up displays in the LCD unit for the operator to perform energy saving operation and help reduce the fuel consumption.



Fig. 13 LCD unit and ECO guidance

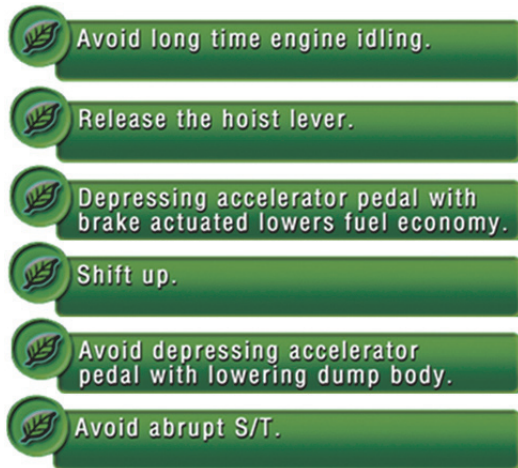


Fig. 14 ECO guidance message examples

In addition, the products are standard equipped with the latest version of the KOMTRAX machine management system.

3.5 Improved maintainability

(1) Ground-level access to the battery box provided

The battery box was repositioned from the platform to the front of the machine inside the bumper. This allows access from ground level and eases daily inspection. In addition, the battery box was upsized so that it can accept larger batteries without placing them separately.



Fig. 15 Battery box (HD465/605-8)

(2) Equipping a battery disconnect switch

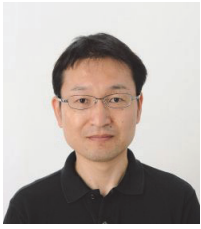
To improve the safety in maintenance work, the battery box is provided with a battery disconnect switch as a standard equipment. In addition, a starter disconnect switch and jump-start cable are available as options. These are placed collectively in a box on the right of the battery box and easily accessible.



Fig. 16 Battery disconnect switch

4. Conclusion

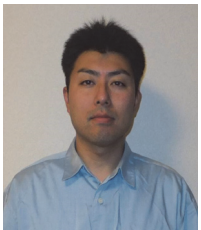
Under circumstances where the Tier 4 Final regulations are already in force before Tier 4 Interim regulations compliant products were released, the products reported herein have been developed to meet the demands for urgent introduction to the market. In this situation, in addition to meeting the regulations, we succeeded to increase the product's appeal by incorporating many new technologies. We will continue to respond quickly to market needs and follow them up so that our products will be well received by our customers.

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[A few words from writers]

Though the development schedule was tight, we succeeded to develop products incorporating various features in addition to meeting the regulations. We will continue with our efforts so that our customers will be more satisfied with our products than ever. We would like to express our gratitude to everyone who contributed to this development.