

Introduction of Products

Off-road Dump-truck HD1500-8

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Following the four machine models from HD325 to HD605 with rated payload ranging from 36.5 t to 63 t, HD1500-8 with a rated payload of 142 t has been introduced to the market. In addition to various latest technologies ever cultivated, this model has achieved further evolution while adding a technology to improve reliability and durability of major components. Outline of the model is introduced in the paper.

Key Words: Off-road dump-truck, Rigid dump, Environment, Safety, ICT, TCS, Monitoring of circumstances

1. Introduction

While conventional models were developed in the U.S. and have been used in mines across the world, improvement has been strongly requested from the market because their basic design has not been modified for about 20 years. As an off-road dump-truck with improved appeal of the product has been developed and introduced to the market adopting the latest technology, outline of the product is introduced here.



Fig. 1 External view of HD1500-8

Table 1 Main specifications

Item	Unit	HD1500-8	
Rated Payload	ton	141.9	
Body capacity (Heaped 2:1/Struck)	m ³	94/65	
Weight	Empty vehicle weight	ton	107.6
	Gross vehicle weight	ton	249.5
Performance	Maximum travel speed	km/h	56.5
	Minimum turning radius (At center of the outside tire)	m	11.2
Dimension	Overall length	mm	12,935
	Overall width (Outside of mirrors)	mm	7,550
	Overall height	mm	6,180
	Wheelbase	mm	5,395
Engine	Model name	—	SDA16V159-3
	Piston displacement	L	50.3
	Rated power (SAE Gross)	kW/min ⁻¹	1,175/1,900
Tire size	—	33.00R51	

2. Aims of Development

Extending overhaul interval and reducing repair expenses and TCO by improving reliability and durability of major components based on “Quality and Reliability.” In addition, increased production volume by improved engine output and reduced production cost in combination with TCO. Appeal of products has been further enhanced by improving safety and utilizing ICT technology. The features are as summarized below:

- (1) Ecology & Economy
 - 1) SDA16V159-3 Engine
 - 2) Transmission
 - 3) Front/Rear Axle
 - 4) Fan Clutch
 - 5) Energy Saving Operation Guide
- (2) Productivity Improvement
 - 1) SDA16V159-3 Engine
 - 2) Small Turning Radius
 - 3) Komatsu Traction Control System (KTCS)
- (3) Improved Operator Comfort & Safety
 - 1) Ergonomically Designed Cab
 - 2) Diagonal Stairway
 - 3) LED Head Lamp, Rear Combination Lamp
- (4) Adoption of ICT Technology
 - 1) Machine Monitor with High Resolution 7-inch Color LCD Unit
 - 2) Maintenance Time Caution
 - 3) Trouble Shooting Function
 - 4) KomVision, All Round Monitoring System
 - 5) Road Condition Analysis
- (5) Improved Maintainability
 - 1) Service Center
 - 2) Fan Drive Equipped with Auto-Tensioner
 - 3) Auto Greasing System
 - 4) Lead-Free Radiator

3. Major Features

3.1 Ecology & Economy

3.1.1 SDA16V159-3 Engine

Exhausted gas regulations made it possible to select equivalent of US EPA Tier2 and fuel consumption optimization (non-emission) CAL. High-torque characteristic and excellent acceleration performance in a low rotation region achieve high productivity with low fuel consumption.

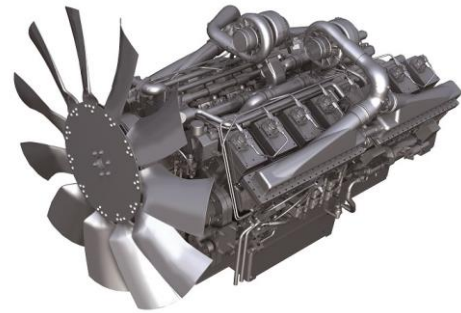


Fig. 2 SDA16V159-3 Engine

3.1.2 Transmission

In relation to the transmission, with improvement of gear train durability, the following fuel consumption reduction technology has been added.

- 1) Make main relief pressure variable
Reduce hydraulic pressure loss by switching the main relief pressure to lower at a gear speed with low clutch holding pressure.
- 2) Switching of main charge flow rate
Reduce hydraulic pressure loss by activating changeover valve with required charge flow rate.
- 3) Make lubricating oil volume variable
Reduce lubricating oil volume by activating variable valve by gear speed and reduce oil pressure loss.

3.1.3 Front/Rear Axle

Durability of axle has been remarkably improved by extending overhaul interval from 12,000 to 16,000 hours. In addition, various improvements were incorporated such as improved maintainability and lightening weight.

3.1.4 Fan Clutch

Reduce horsepower loss caused by fan while maintaining cooling performance. Fan clutch operates in accordance with the temperature as described below:

- 1) Cooling water temperature
- 2) Air intake temperature
- 3) Fuel temperature
- 4) Refrigerant pressure

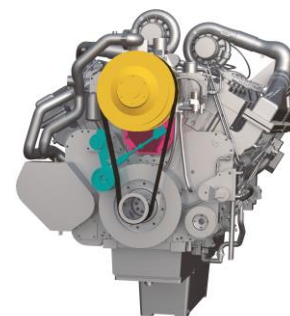


Fig. 3 Fan clutch

3.1.5 Energy Saving Operation Guide

Support energy saving operation by displaying ECO guidance which gives the operator an advice on the saving energy operation and instant fuel consumption ratio during operation on LCD unit.

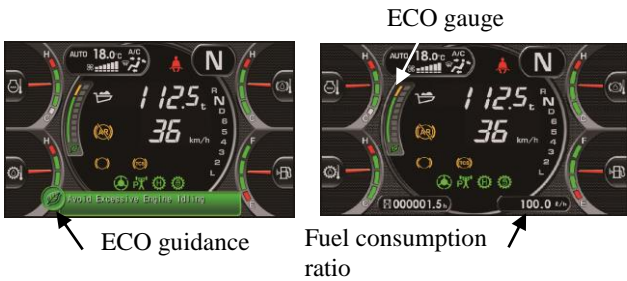


Fig. 4 ECO guidance, Fuel consumption ratio

3.2 Productivity Improvement

3.2.1 SDA16V159-3 Engine

Engine gross output has increased by 6% compared with existing model at 1,175 kW (1575 HP) at 1,900 rpm. High-output engine achieves excellent acceleration performance and travel performance.

3.2.2 Small Turning Radius

As a large steering angle is obtained by Komatsu's traditional McPherson strut (A arm) type front suspension, outstanding small-turn performance has been achieved in spite of its long wheelbase and wide tread. It is possible to promptly move to intended position at loading and dozing places.

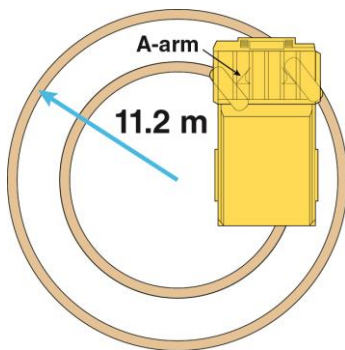


Fig. 5 Small turning radius

3.2.3 Komatsu Traction Control System (KTCS)

KTCS constantly monitors slip of tires by rotation speed and travel speed of rear tires. In case of excessive slip of tire, adjust slip ratio of tires by automatic braking to maintain optimum traction state. As the result, KTCS improves production capabilities and service life of tires compared with conventional ASR. With no operation by operator required, KTCS operates automatically.

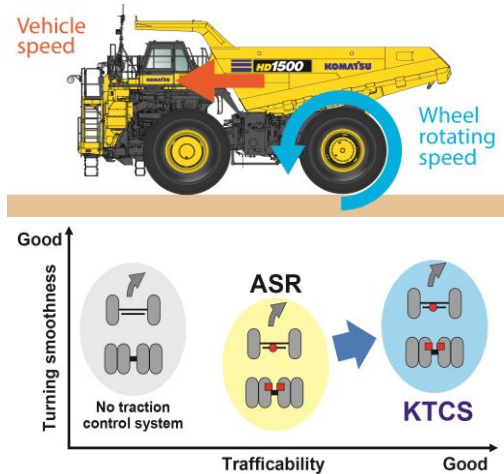


Fig. 6 Komatsu Traction Control System

3.3 Improved Operator Comfort & Safety

3.3.1 Ergonomically Designed Cab

The ergonomically designed operator's compartment provides the operator with a convenient control layout and comfortable environment for more confident operation and greater productivity.



Fig. 7 Round type dashboard

3.3.2 Diagonal Stairway

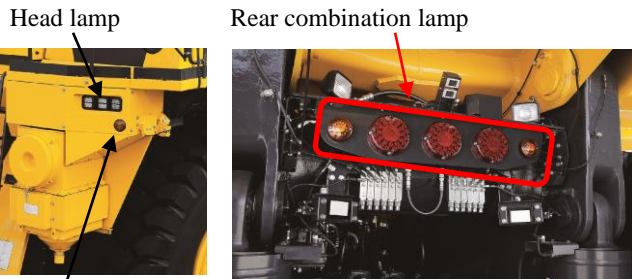
The low angle diagonal stairway have been adopted at the path toward cab and deck for easier elevation. Safety has been secured by arranging an emergency ladder equipped with a gate and handrails on the right and left of the chassis.



Fig. 8 Diagonal stairway

3.3.3 LED Head Lamp, Rear Combination Lamp

Long service life as well as excellent visibility and economic efficiency has been achieved by equipping with head lamp, direction indicate lamp, rear combination lamp, PLM lamp and LED lamp on a standard basis.



Direction indicate lamp

Fig. 9 LED lamp

3.4 Adoption of ICT Technology

3.4.1 Machine Monitor with High Resolution 7-inch Color LCD Unit

Machine monitor displays not only vehicle conditions, but also various information such as actual operation results, maintenance information and energy saving guidance for operator to be able to easily confirm. Further, various operation and setting of vehicle have become available by operation of switch panel such as setting of air conditioner and switching of LCD unit screen.



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

3.4.2 Maintenance Time Caution

As timing of periodic maintenance such as filter exchange gets closer, remaining time until the maintenance is displayed on LCD. It is possible to set timing for starting display within a range from 10 to 200 hours.

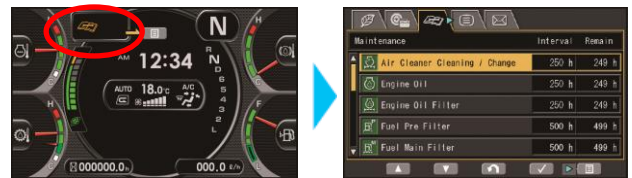


Fig. 11 Maintenance time caution

3.4.3 Trouble Shooting Function

As various meters, gauges and cautions are disposed on the LCD unit, operation start check is easy to be done. Also, in case of any abnormality during operation, alarm is caused by a lamp and buzzer. With display of action code shown by four stages according to the degree of emergency, urge operator to cope with appropriately.

3.4.4 KomVision, All Round Monitoring System

Six units of camera and eight units of radar are mounted respectively on the chassis. Operator is able to check safety around the chassis with KomVision monitor and rearview monitor. The system assists operator at the time of startup and during low speed travel at loading and maintenance sites. In addition, in the case where any object is within a detection area, notify the operator by alarm sound with a small o mark displayed on the monitor.

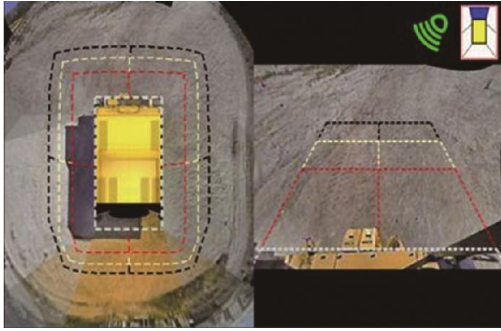


Fig. 12 KomVision, all round monitoring system

3.4.5 Road Condition Analysis

Road surface conditions during traveling are analyzed and recorded based on various information including each suspension pressure, angle of inclination, steering angle, traveling speed, and hauling capacity. Road condition analysis results are reported to clients with geographic data via KOMTRAX Plus. With recommendations of appropriate travel speed and road surface maintenance timing included, the reported data works as an effective tool to utilize the machine to the maximum. It is under development.

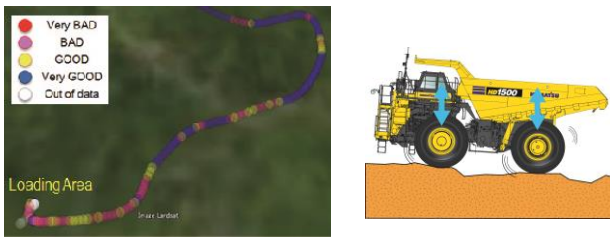


Fig. 13 Road condition analysis

3.5 Improved Maintainability

3.5.1 Service Center

Service center is arranged under a steering/hoist oil tank. Ports of the engine oil, coolant, transmission oil, steering/hoist oil and brake cooling oil are centrally arranged in one place so that the refilling operation is easily performed.

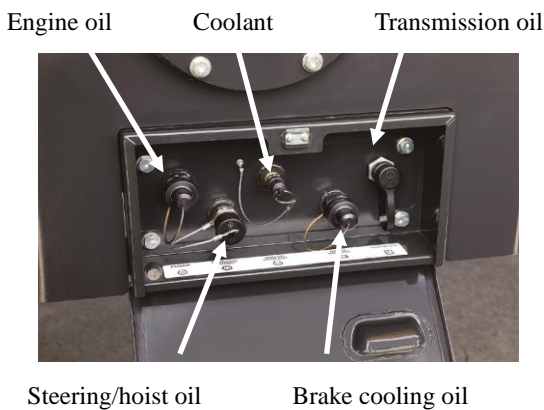


Fig. 14 Service center

3.5.2 Fan Drive Equipped with Auto-Tensioner

Maintenance-free auto-tensioner pulley has been adopted for tension of drive belt for engine cooling fan.

3.5.3 Auto Greasing System

Grease is automatically supplied to each greasing point with predetermined time interval. Relief port is accessible to reservoir from the ground.

3.5.4 Lead-Free Radiator

Adopted lead-free radiator in consideration of environment. Because every single tube of this radiator is independent, it is possible to exchange only damaged tube(s) and to save suspension time of the vehicle by easy repair work.



Fig. 15 Lead-free radiator

4. TCO Reduction Effect

By improving durability of major components as well as extending overhaul interval and reducing repair expenses, TCO has been reduced by 4.4%. In addition, production volume has been increased by improved engine output and production cost has been reduced in combination with TCO reduction.

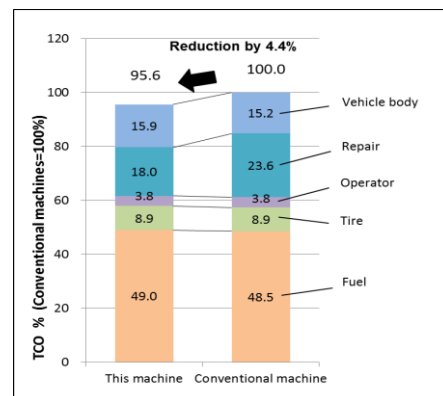


Fig. 16 TCO Reduction Effect

5. Conclusion

In this paper, we introduced an off-road dump-truck for which full model change was performed for the first time in about 20 years. We have successfully developed a vehicle excellent in reliability and economic efficiency by improving durability while enhancing appeal of products by adding various latest technologies in the course of the current development. This model has been in operation worldwide on a successful note. We would like to continuously support and follow up our clients from now on too so that our products will acquire good reputation from them.

Introduction of the authors



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[A comment from the authors]

Even though it took a long period of time to develop this machine due to various difficulties, it has been introduced to the market finally. We have developed a vehicle with great appeal by incorporating various latest technologies and properties. We have determined to promptly support for any problem occurred in the market from now on in order to satisfy clients. Finally, we would like to express our special thanks to all persons involved in the development.