Introduction of Product

Introduction of Dump Truck Model HD785-7

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Following the changing of models to the Dump Truck Model HD785-5, a new model HD785-7 has been developed and introduced to the market; featuring higher productivity, improved fuel economy and compliance with regulations. The features of the new dump truck are described.

Key Words: *HD785-7, dump truck, EPA Tier2 emission regulation, variable horse power control, full hydraulic control 4-wheel wet type brake system, two-speed selection reverse gears, variable transmission main relief pressure, transmission lubricating oil quantity control, independent torque converter-transmission pumps*

1. Introduction

Since its market introduction in 1997, the 90t rigid dump truck model HD785-5 has been highly acclaimed by users for its comfortability, retarder brake performance and other parameters. Nevertheless, nine years have passed after its market entry and its product power has required a revamp in view of the market changes and the quality improvement of competing machines.

Furthermore, compliance with social regulations, such as the EPA Tier2 emission regulation that has been enforced on this class of machines since 2006, has been demanded.

With this in mind, the HD785-7 dump truck, which simultaneously combines excellent productivity and fuel economy, has been developed as described below.

Photo 1 HD785-7

2. Aims of Development

Aiming to maintain the product superiority of existing machines, the further upgrading of productivity, fuel economy, safety and comfortability, as well as compliance with environmental conditions and regulations, were targeted. The development aims were set as described in **Table 1**.

Table 1 Development aims and implementation components

Aims		Implementation components
Productivity	Travel performance	Engine output largest for the class
		Two-speed selection reverse gears, direct backward traveling Increase in torque converter oil cooler capacity
	Body shape	Optimum body shape
Fuel economy	Fuel consumption	Variable horse power control, optimum shift control, less hydraulic loss
	Durability, maintainability	Fully hydraulic brake control (air equipment eliminated)
		4-wheel wet type brakes (parking brake contained)
		Increase in suspension cylinder and brake disc capacities
		Easy mounting and dismounting of tires (flange type rim)
	Monitoring and machine management	VHMS equipped as a standard provision, new monitoring system
Safety	Safety during braking	4-wheel retarder (ARSC equipped as a standard provision)
	Brake reliability	Wet type brakes on four wheels
	Brake control	Fully hydraulic brake control
	Safety on rear-end collision	4-post ROPS/FOPS cab
Comfortability	Gear shift shock	E/G-transmission interlock control, skip shift
	Body attaching shock	Electric hoist control
	Noise at the operator's station	Higher cab quietness, hybrid fan
Environmental conditions		Engine complying exhausted gas regulations, aluminum radiator
		Tank for recovering brake cooling oil

3. Principal Features

3.1 Enhanced productivity

1) Larger engine output

Installed with a KOMATSU SAA12V140E-3 engine, the maximum output is increased to 895kW (1217PS), the largest in its class.

2) Body dimension change

A body shape best matching large excavators as more large excavators are dumping onto dump trucks recently, aside from large loaders.

3) Two-speed selection reverse gears

The number of backward gear shifts has changed to two shifts (RH/RL), allowing the selection of a more suitable shift for particular field work. The two shifts also incorporate an automatic lock-up function permitting continuous backward uphill travel without worrying about overheating. (**Fig. 1**)

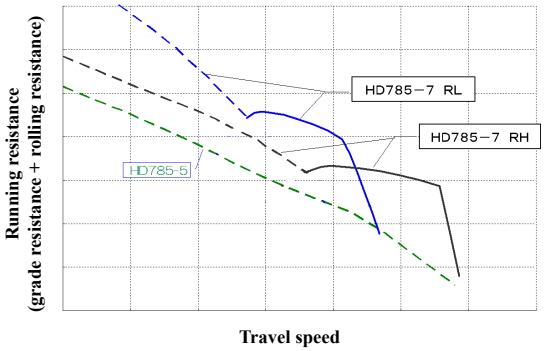


Fig. 1 Curves of backward travel performance

3.2 Low fuel consumption

1) Variable horse power control (VHPC)

Variable horse power control (VHPC: Variable Horse-Power Control) has newly been employed to achieve both considerable engine output and low fuel consumption at the same time. In addition to the existing mode change system of changing the mode to Mode P or Mode E by operating a switch on a panel at the operator seat, depending on the travel conditions and required work rate, this system automatically changes the engine power to high output when earth is being loaded onto and to low output when detecting the loading of earth or idling by the vehicle itself, which has significantly reduced fuel consumption. (**Fig. 2**)

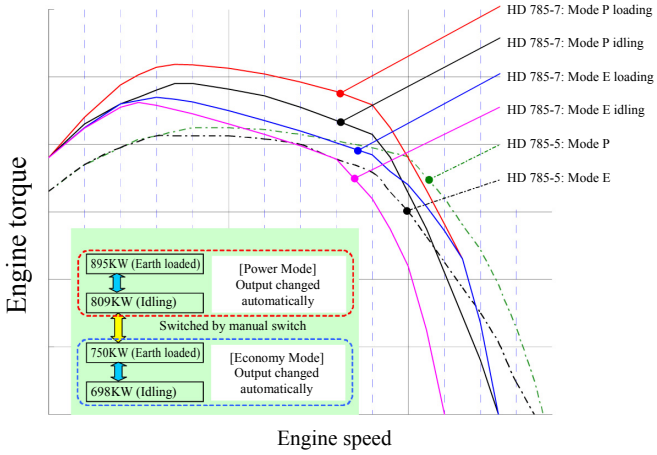


Fig. 2 Variable horse power control (VHPC)

2) Optimum shift control

Fuel economy is improved by shifting up early to control the engine speed when the accelerator pedal is touched only lightly and the vehicle is not accelerated fast. Conversely, when acceleration is necessary and the accelerator pedal is stepped on, shifting up of the engine to the maximum output is prevented and the power of the engine is fully demonstrated.

3) Reduction of loss horsepower

Loss horsepower is reduced by making transmission the main relief pressure variable, via the transmission lubricating oil quantity control and by making the torque converter charge pump and transmission control pump independent. (**Fig. 3**)

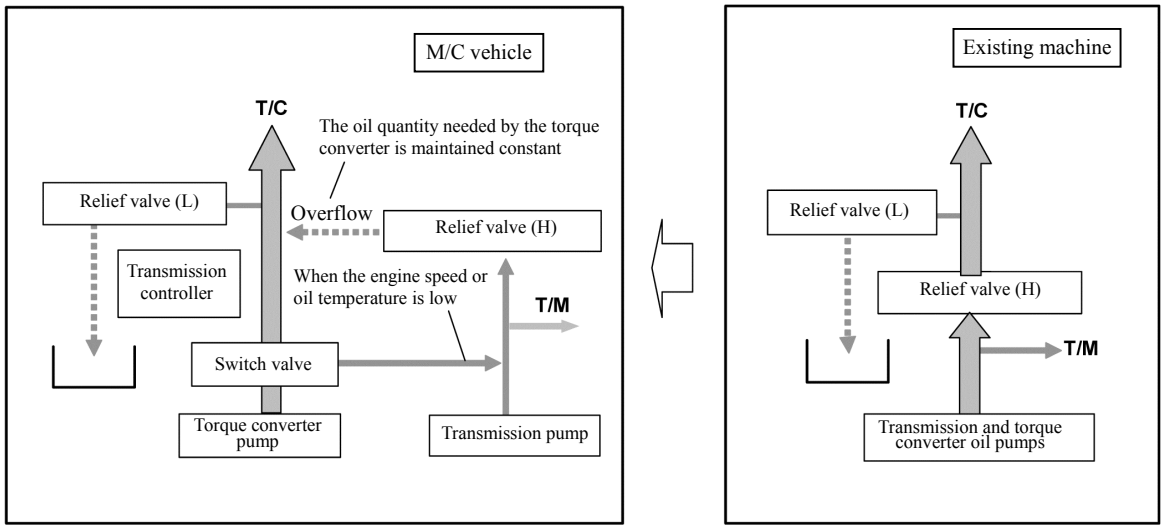


Fig. 3 Independent torque converter charge pump and transmission control valve

Incorporating the foregoing functions, fuel consumption could be drastically reduced compared with a existing model. (**Table 2**)

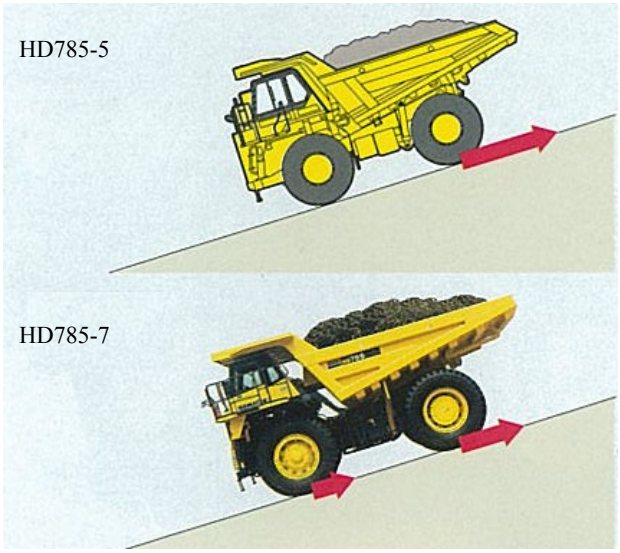
Table 2 Comparison of fuel consumption by new and existing models

	HD 785-7	HD 785-5
Fuel consumption per work rate (Liters/ton)	87	100

* In-house test data. Model 5 based as 100.
Medium light load course, Mode E
Values vary during actual work, depending on the actual conditions and work involved

3.3 Enhanced safety and comfortability

1) New cab
   (1) Large cab integrating ROPS and FOPS
   A built-in cab integrating ROPS and FOPS is adopted. The cab ruggedness is reinforced by applying the ROPS structure to the cab pillars, thereby enhancing operator safety.
   (2) Low noise and vibration
   The airtightness of the cab is enhanced to prevent sound intrusion. Low engine speed and hybrid cooling fan reduce engine noise, drastically reducing noise inside the cabin.
   The cab mount is a viscous mount that excels in dampness, providing a quiet dwelling space with less vibration.
2) Enhanced brake reliability
   (1) Fully hydraulic control 4-wheel wet type brakes
   All the brakes, including the parking brake, are wet type brakes and operated by fully hydraulic brake control. Because dry brakes are not used, the braking system is maintenance free and braking can be applied without worrying about brake pad wear, greatly enhancing reliability. Both the service and retarder brakes feature a brake feeling with reduced time lag and an effective response.
   (2) 4-wheel retarder
   4-wheel retarder (AP-FOUR [four-wheel oil-cooled multi-disc retarder with anti-pitching function]) that applies braking to all front and rear wheels is used.
   The load onto the tires is equalized by applying part of the braking force to the front wheels, instead of braking only the rear wheels, reducing locking of the rear wheels that causes unstable behavior and enhancing safety. The retarder ability is demonstrated more effectively. (**Fig. 4**)



* Anti-pitching function: The function to individually control braking forces during retarder operation prevents pitching.

Fig. 4 4-wheel retarder (AP-FOUR)

   (3) Electric dump control
   Dump control is changed to electric control. A sensor detects the body attaching time immediately before the body attaches and the body descending speed is controlled by hydraulic control, greatly reducing the body attaching shock.

3.4 Compliance with environmental conditions and regulations

The dump truck is installed with the KOMATSU SAA12V140E-3 engine meeting both US EPA Tier2 emission regulation and EU exhausted gas regulation Stage2.

3.5 Enhanced maintainability

1) New monitoring system and failure diagnosis function
Various meters and caution lamps are installed on the instrument panel for an understanding of the vehicle condition at a glance. In case of any trouble with the vehicle, an alarm lamp cautioning the trouble will light up (flash), displaying the nature of the trouble and troubleshooting method in code No. and in a message on the character display. By taking action before a trouble develops into a major failure, the machine downtime can be shortened and repair costs reduced.
2) VHMS equipped as standard provision
Real-time, centralized management of operational data of the major components is now available as a standard specification. Continual monitoring of operational data enables actions to be taken for preventive maintenance against vehicle failures, thereby ensuring correct vehicle maintenance and reducing the vehicle downtime.
3) Disc wheel (Flange type rim)
A change from the wedge type to the disc type (flange type) for the fixing of the wheels facilitates wheel mounting and dismounting. (**Photo 2**)

HD785-7 Flange type

HD785-5 Wedge type

Photo 2 Flange type rim

4) Enhanced durability of the suspension system
The durability of the suspension system has been enhanced by reducing the bearing stress onto bushing surfaces via an increase in the rod diameter, by enhancing the heat resistance of the rod packings and buffer rings and by improving the sealed oil.

4. Market Introduction

The dump trucks that started operation in Indonesia and other markets are working smoothly. “High power” and “high fuel economy” are especially acclaimed by users.

Photo 3 HD785-7 in action

5. Conclusion

Achieving engine output that is largest for the class and low fuel consumption, as well as 4-wheel wet type brakes of the full hydraulic control type, proved to be the most difficult tasks in the development process. However, improvement could be incorporated in major components, including the body, engine, transmission and axle, accomplishing the development aims.

Introduction of the writers

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[A few words from the writers]

It was fortunate for the writers to have been able to participate in the development of a full changing of models of HD785, one of the main dump truck models, incorporating a wealth of new technologies.

During the market introduction, many operators were heard to declare “Good!” in response to the dump truck operation, thereby rewarding the many difficulties encountered by the writers.

The many lessons learnt in the development process will be utilized in future work.