

## Introduction of Products

### Medium-size Wheel Loader WA470/475-10

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*We have developed the WA470/475-10, a medium-size wheel loader that is equipped with Komatsu's first new transmission, Komatsu Hydraulic Mechanical Transmission (KHMT), and incorporates functional enhancements in all aspects, including "Economy", "Productivity", "Safety", "Easy Operation", "Operator environment", and "Easy Maintenance", on the conventional machine, WA470-8, released in September 2016. This paper presents its main features. (Japanese model name: WA470-10; overseas model name: WA475-10)*

**Key Words:** WA470-10, WA475-10, wheel loader, Tier 4 Final, KHMT, Independent Work Equipment Control, low fuel consumption, Travel Speed Control Dial, newly designed cab, Power tiltable engine hood

## 1. Introduction

The conventional machine, WA470-8, was marketed in 2016 as a model change vehicle compliant with the exhaust gas Tier 4 Final regulations.

This paper outlines the WA470/475-10 wheel loader that we have developed so that it incorporates the latest technology and has both productivity and economic efficiency under the background that it is required to satisfy the needs of fuel consumption reduction, workability improvement, etc. in consideration of the situation of model change in competitor machines.



**Fig. 1** Example of WA470/475-10 (for WA470-10)

## 2. Aims of development

While complying with the fourth-generation exhaust gas regulations, the WA470/475-10 has reduced fuel consumption and improved the productivity, safety, easy operation, operator environment, and easy maintenance to greatly upgrade the competitiveness.

The features of the functions newly installed to the WA470/475-10 are detailed below.

- (1) Economy and Productivity
  - 1) Komatsu Hydraulic Mechanical Transmission (KHMT)
  - 2) New bucket design
  - 3) Breakout force increased (by lift cylinder)
  - 4) New load meter
- (2) Easy Operation
  - 1) Independent Work Equipment Control
  - 2) Travel Speed Control Dial
  - 3) Auto Hill Holding Function
- (3) Operator Environment
  - 1) Newly Designed Cab
  - 2) 5-way Adjustable Console and Integrated Switches
  - 3) Command Selector
  - 4) New Steering Column
  - 5) Electric Mirror with Heater

- (4) Safety
  - 1) Rear combination LED lamp
  - 2) LED lamp
  - 3) Anchor point of Tie-off
- (5) Easy Maintenance
  - 1) Powered Tilttable Engine Hood
  - 2) Steps for easy window cleaning
- (6) Ecology
  - 1) Equipped with clean engine Komatsu SAA6D125E-7

### 3. Major features

#### 3.1 Economy and Productivity

##### 3.1.1 KHMT

For transmission, this machine has a KHMT that consists of a combination of a hydrostatic transmission (HST) that allows stepless speed change using a variable displacement hydraulic pump and motor and a high-efficiency mechanical transmission.

This machine has implemented low fuel consumption, high productivity, and easy operation by adopting the KHMT control system for gear shifting control.

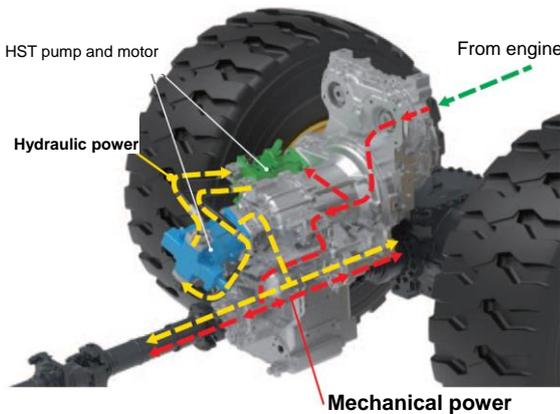


Fig. 2 Equipped with KHMT

The control system of the KHMT comprehensively judges the machine condition and the loads during operation. It controls the engine speed, and the distribution of engine power automatically to optimize acceleration, traction and power for the work equipment, while maintaining a lower, more constant engine speed. In addition, an operator can control the machine intuitively and achieve optimal operation easily. As a result the WA470/475-10 has high productivity, low fuel consumption and less operator fatigue.

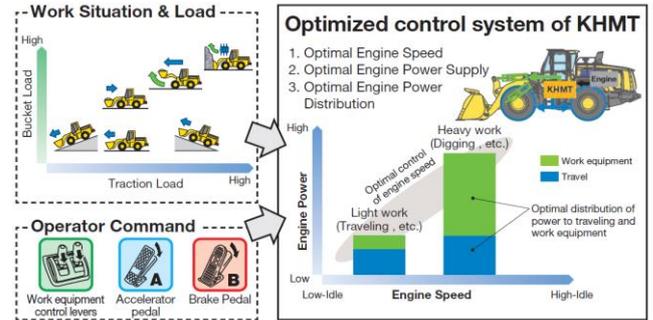


Fig. 3 Optimized control system of KHMT

##### 3.1.2 New bucket design

This machine comes standard with a newly developed bucket with excellent excavation performance. The work efficiency has been improved by revising the scooping up performance, bucket fill factor, and material holding performance.

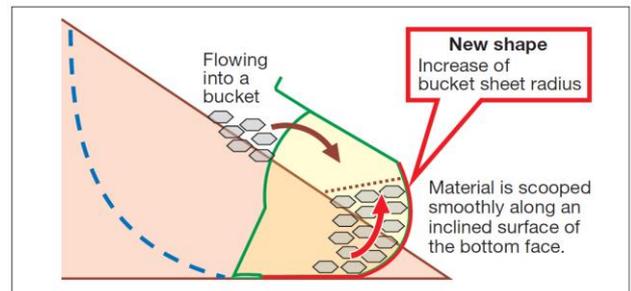


Fig. 4 Excavation performance improved by the reshaped bucket

##### 3.1.3 Breakout force increased (by lift cylinder)

The rated load has been improved by 15% compared to the conventional machine so that heavier materials can be lifted. As a result, heavier density materials can be lifted even with a bucket having the same capacity as the conventional machine.

In addition, the breakout force by lift cylinder has been improved by 20% compared to the conventional machine, resulting in significant improvement in workability and productivity.



Fig. 5 Improved breakout force by lift cylinder

### 3.1.4 New load meter

Load meter accuracy has been improved; in addition, convenient functions have been added.

The work equipment can be raised and weighed automatically by pressing the load meter auto measurement switch on the right console. By using this function, further improvement in accuracy has been achieved.

In addition, it has a no load calibration function that enables the operator to improve the weighing accuracy only by pressing the load meter empty bucket calibration switch before starting daily work or between one work session and another.

This machine can reduce wasteful loading work through the dumping monitoring function that displays the remaining weight in the bucket on the monitor in real time, for example, during loading onto the dump truck.

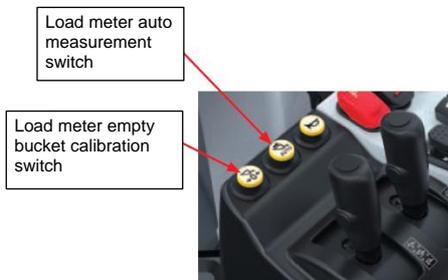


Fig. 6 Load meter new function switch



Upper row: Display of bucket load  
Lower row: Display of total / remaining target load  
Change in real time

Fig. 7 Load meter monitor screen

### 3.2 Easy operation

#### 3.2.1 Independent work equipment control

The work equipment speed is now controllable only with the control lever. Unlike the conventional machine, the operator no longer needs to depress the accelerator pedal to control the work equipment speed, thereby reducing his/her fatigue.

Since the work equipment speed is controllable by the control lever alone, the combined operation of traveling and the work equipment can be simplified.

The work equipment speed and travel speed are now controllable independently using the lever and accelerator, respectively, and the operator no longer needs to depress the brake pedal during combined operation; this simplifies the approach to dump trucks and eliminates dragging of brake, which contributes to improvement in fuel consumption efficiency.

The measurement result of our in-house test showed that the pedal operating frequency in one cycle of V-shape loading was reduced by 22% for the accelerator pedal and 75% for the brake pedal.

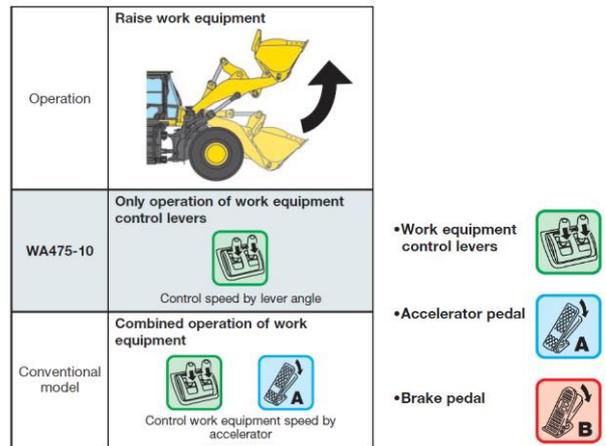


Fig. 8 Independent work equipment control (work equipment operation)

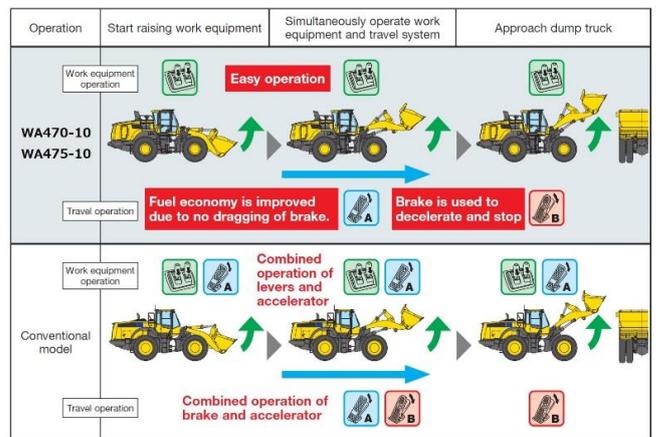
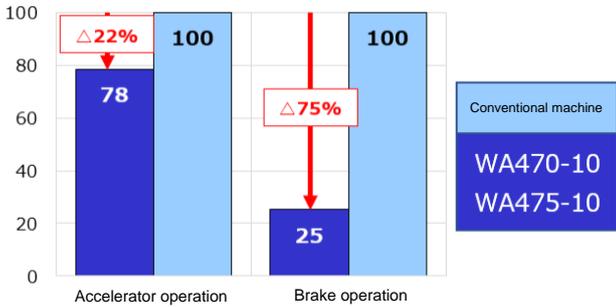


Fig. 9 Independent work equipment control (approach to dump truck)

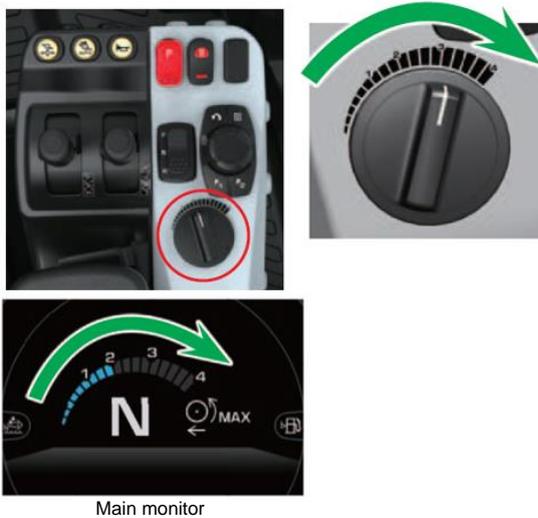


**Fig. 10** Pedal operating frequency comparison for 1 cycle of V-shape loading

**3.2.2 Travel speed control dial**

By turning the dial placed on the right hand console, the maximum speed of vehicle can be easily set. This works during flat travel or when traveling downhill as well as during V-shape loading, depending on the worksite or environment; Since the operator does not need to control the traveling speed by operating the accelerator, the fatigue of the operator is greatly reduced.

In addition, since it controls the engine power required for the vehicle to maintain the travel speed, therefore enabling the fuel consumption to be reduced as well.



**Fig. 11** Travel speed control dial

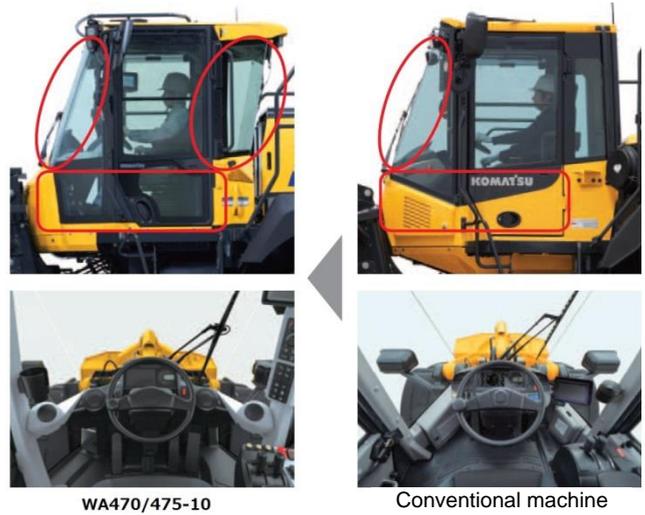
**3.2.3 Auto Hill Holding Function**

Sliding down of the machine is prevented with this function on uphill such as traveling and pile up operation even if the operator does not apply brake pedal. It makes operation easier and the operator is less fatigued.

**3.3 Operator environment**

**3.3.1 Newly designed cab**

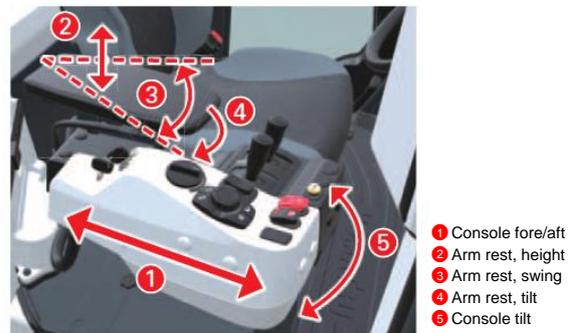
This machine adopts a cab newly designed both in the engineering and appearance aspects. It has glass windows extending up to the floor at the operator’s feet and has a rear glass window arranged diagonally for easily looking outside, with the rear pillar abolished. This has further improved visibility, and the operator can operate more safely.



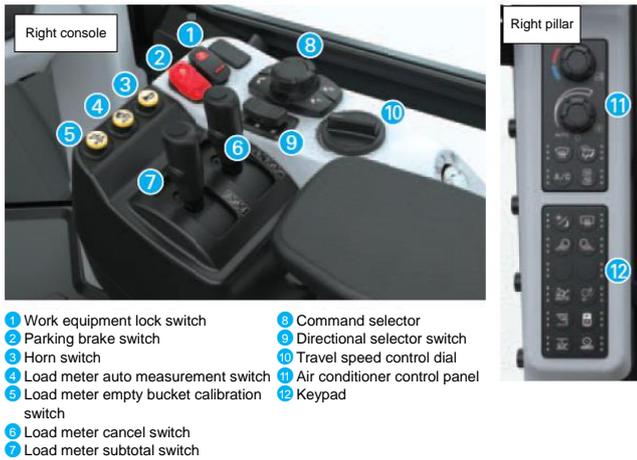
**Fig. 12** Newly designed cab: Comparison with the conventional machine

**3.3.2 5-way adjustable console and integrated switches**

This machine adopts a new right hand console adjustable in five directions. In addition, switches for frequent use during operation (Horn Switch, Parking Brake Switch, Travel Speed Control Dial, Air Conditioner Switch, Working Lamp Switch, Directional Selector Switch, etc.) are integrated into right hand console and front pillar. Operator can access these switches without changing posture. It make an operation more comfortable and effortless.



**Fig. 13** 5-way adjustable console



- 1 Work equipment lock switch
- 2 Parking brake switch
- 3 Horn switch
- 4 Load meter auto measurement switch
- 5 Load meter empty bucket calibration switch
- 6 Load meter cancel switch
- 7 Load meter subtotal switch
- 8 Command selector
- 9 Directional selector switch
- 10 Travel speed control dial
- 11 Air conditioner control panel
- 12 Keypad

Fig. 14 Integrated switches

### 3.3.3 Command selector

This machine adopts a command selector for operation of the main monitor, which allows the operator to operate it more intuitively.

Shortcut switches can be set for frequently used menus.



Fig. 15 Command selector

### 3.3.4 New steering column

This machine adopts a new steering column of flip-up storage type. It can be easily stored with only one pedal, improving the accessibility in getting on/off the machine. The steering column angle is also easily adjustable by pedal operation, improving the operator's comfortableness during vehicle operation.



Fig.16 New steering column

### 3.3.5 Electric mirror with heater

This machine has rearview mirrors that are electrically angle-adjustable through the switch within the cab. Each mirror has a heater for preventing the mirror from being cloudy and iced in cold weather, thereby facilitating securing visibility.

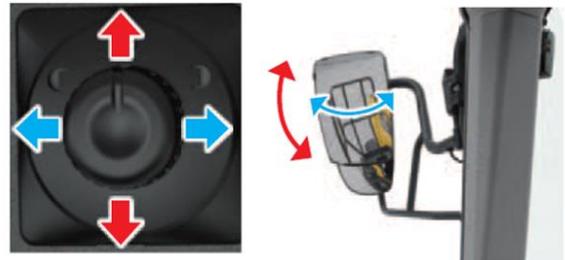


Fig. 17 Electric mirror

## 3.4 Safety

### 3.4.1 Rear combination LED lamp

This machine adopts a rear combination LED lamp with long service life. This lamp integrates the turn signal, stop / tail, reverse and reflectors. The lamp is built into the rear counterweight to prevent damage.



Fig. 18 Rear combination lamp

### 3.4.2 LED lamp

LED lamps are equipped on various positions of the machine. The visibility under low light environment is improved, and work at night can be done safely.

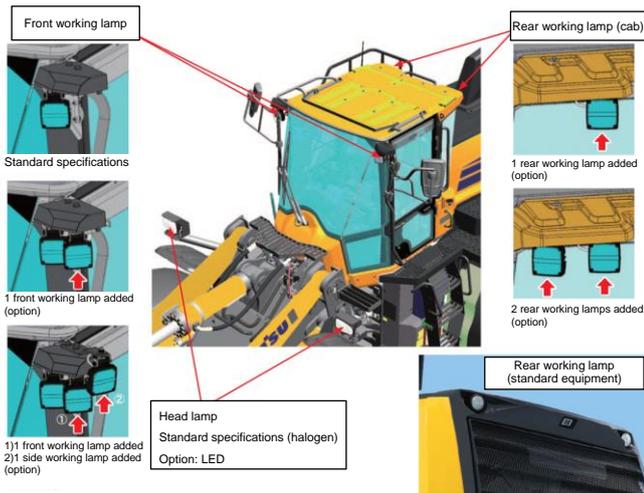


Fig. 19 LED lamp

### 3.4.3 Anchor point of Tie-off

This machine has anchor points for a safety belt used to prevent a fall accident of the worker during maintenance, cleaning, inspection of the machine.



Fig. 20 Anchor point of Tie-off

## 3.5 Easy maintenance

### 3.5.1 Powered tiltable engine hood

This machine adopts a new engine hood that opens and closes as a whole with an electric motor, which significantly improves the maintainability inside the engine hood. The hood control switch is located around the battery box on the left side of the machine, thereby enabling easy operation.

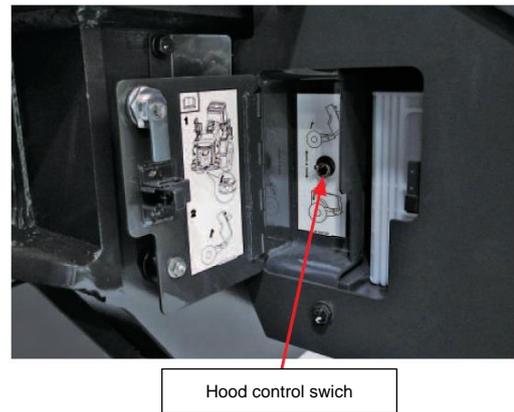


Fig. 21 Hood control switch

(1) Hood open (during substantial repair)

This machine enables the worker to easily access the engine and aftertreatment devices, thus enabling easy replacement of these.

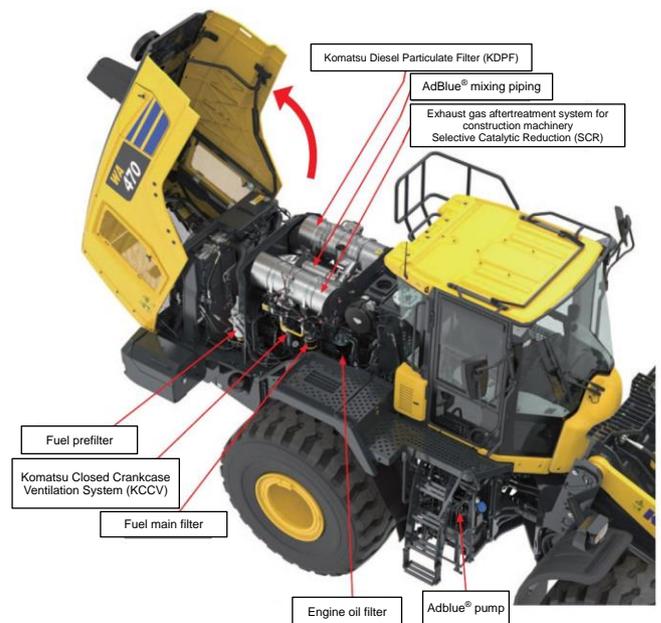


Fig. 22 Hood open

(2) Daily maintenance

This machine has an engine hood side cover for daily maintenance. For the access to the air cleaner housed in the engine compartment (for the conventional machine: located on the platform), an exclusive small window is equipped to enable safe access from the platform. The engine hood adopts a structure that allows daily maintenance to be performed without opening itself.



Fig. 23 Daily maintenance access points

### 3.5.2 Steps for easy window cleaning

This machine has convenient steps for cleaning the cab front glass, a tie off anchor-point to prevent a fall of the worker during cleaning, and a roof handrail.

The mirror on the left side of the machine is foldable out of the way during access to the steps, enabling safe cleaning work.



Fig. 24 Steps for easy window cleaning

## 3.6 Ecology

### 3.6.1 Equipped with clean engine Komatsu SAA6D125E-7

This machine has a Komatsu SAA6D125E-7 engine, which is a new generation clean engine compliant with U.S. EPA Tier 4 Final and EU Stage 5 emissions regulations.

To prevent temperature rise in the engine hood after the engine stops, with the mounting direction of the aftertreatment device altered from the conventional machine, the wind flow after engine shutdown has been improved to reduce the temperature rise in the engine compartment.

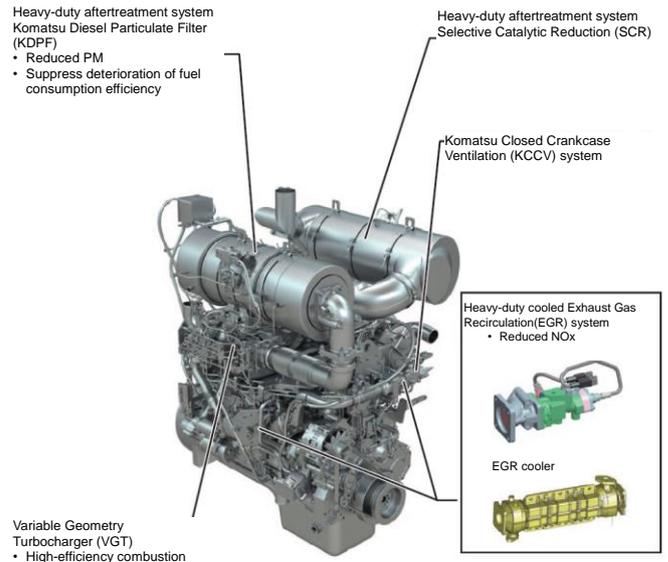


Fig. 25 Komatsu SAA6D125E-7 engine

## 4. Conclusion

In the last few years, Komatsu’s medium-size wheel loader development proceeded with the emphasis on the development to meet the exhaust gas regulations; however, as meeting the exhaust gas regulations was settled down, this development started in an attempt to develop a vehicle that satisfies the needs of our customers.

As detailed earlier, we made a plan to renew the whole including even the appearance design as well as economic efficiency and workability and proceeded with the development.

Taking advantage of Komatsu’s advantage of producing key components in-house, we succeeded, in a short time, in completing the development of even the KHMT (a key component of this vehicle incorporating many new technologies) by the design, testing, and production departments, which joined together.

Although our primary goal is to steadily create products that will please our customers as the market is currently being expanded overseas and in Japan, we would like to continue to support them through the WA470/475-10 so that we can further develop vehicles meeting requests from customers.

**Introduction of the authors****Takuya Muramoto**

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**[A comment from the authors]**

In the development of the WA470/475-10, we faced many challenges during the development due to our full model change after a long absence, and we continually encountered difficulties.

This vehicle has begun to be marketed overseas and has received high praise for its new functions that incorporate the superior fuel consumption efficiency and workability and the ease of machine operations and controls; we feel that our hard work in the development has paid off.

We may receive various sorts of information from our customers also from now and would like to respond quickly and politely to each and every one of them.