

Introduction of Products

Mining Motor Grader GD955-7/7M0/7R

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We have developed the mining motor grader GD955-7, which has significantly improved productivity and availability, and is equipped with the latest safety equipment. We would like to introduce its main features.

Key Words: GD955-7, Motor grader, Mining, Raised vehicle classification, Increasing engine output, Bearing type circle, Circumference monitoring

1. Introduction

The conventional model GD825A-2 having over 30 years after its launch into the market had not met the demands from customers such as information system and production improvement, as well as the regulations of exhaust gas and safety. Also, a large grader to match the HD758 to the 830E classes had been strongly demanded to be developed, as the result of the field research in the major market. Adopting these voices and the latest technologies, we have developed Komatsu's first full-fledged mining motor grader, the GD955-7. Here we would like to introduce its outline.



Fig. 1 GD955-7

2. Aims of development

To make the vehicle the "DANTOTSU" mining motor grader, we set "significant increase of production" by raising vehicle classification and engine output and "availability improvement" by adopting the bearing type circle as its DANTOTSU features in its development. In addition, we prepared three types of engines to meet "the forth regulation", "the third regulation", and "equivalent to the second regulation" of exhaust gas so that we can provide this model globally. All this is summarized below.

- (1) Improved productivity
 - 1) Raised vehicle classification
 - 2) Increasing engine output
- (2) Improved availability
 - 1) Adoption of bearing type circle
 - 2) Improved removal and installation of components
 - 3) Adjustable blade rail guide
- (3) Improved safety and comfort
 - 1) Cab design with security and safety
 - 2) Adoption of electric levers
 - 3) KomVision system mounted
 - 4) Improved accessibility
 - 5) LED lamps equipped as standard
- (4) Improved maintainability and standardized mining equipment
 - 1) Auto-greasing
 - 2) Service center
 - 3) Sampling ports
 - 4) Disconnect switch
 - 5) Vehicle management by Komtrax Plus
 - 6) Collective filters layout
 - 7) Wet type parking brake

3. Major features

3.1 Improved productivity

For efficient maintenance of dump truck haul roads in mining sites, the GD955-7 is made to wear the 18 feet blade as standard and the 20 feet blade as option, while the conventional GD825A-2 wears the 16 feet blade. Moreover, the engine output has significantly been increased by 49% to increase the working travel speed, which realizes the increase of the production (grading area per hour) by 33% with the 18 feet blade and by 46% with the 20 feet blade, compared to the GD825A-2. The 18 feet blade has a higher linear pressure (pressing load per blade length) than that of the competing machines with a focus on the workability on hard road surface. The 20 feet blade has the aim of higher work efficiency with the two feet longer blade.

- 18 feet blade as standard:
for comparatively hard road surface such as hard rock mining and frozen road surface
- 20 feet blade as option:
for comparatively soft road surface expecting workability such as soft rock mining and large-scale construction

3.1.1 Raised vehicle classification

(1) Vehicle size and weight

The GD955-7 has the vehicle size allowing operation without concern about interference of the body and the 20 feet blade with the wheelbase 17% longer than that of the GD825A-2. On the other hand, although the tread is larger than that of the GD825A-2 for improving the stability, it is minimized with the consideration of passing each other on a haul road. The vehicle weight is increased by 50% from the GD825A-2 to improve the digging performance on hard road surface.

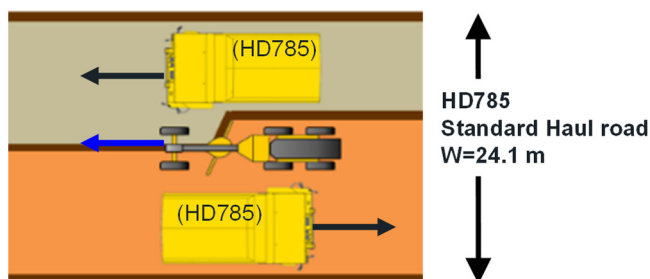


Fig. 2 Crossing ability

(2) Turning radius

As a trade-off of the extension of the wheel base, the turning radius becomes larger to lower the U-turn performance. The GD955-7 has the turning radius similar to the 16 feet blade vehicles of the competitors by increasing the steering angle and the articulate angle, which realizes a small turning radius for the vehicle size. This enables U-turn without K-turn on a haul road for dump trucks of the HD785 class. The vehicle can match with dump trucks of wide range of sizes.

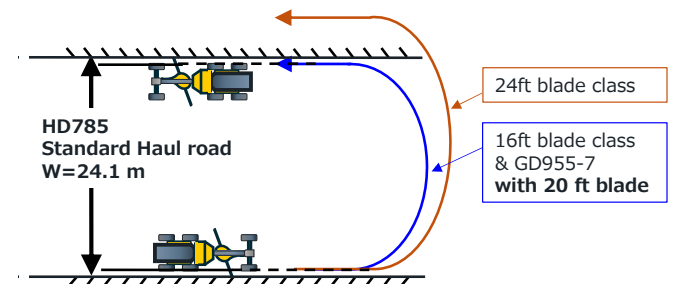


Fig. 3 U-turn performance

(3) Durability

We had no durability standard for a newly-developed mining motor grader, so we started from the creation of the standard. Having the opportunity enabling load measurement at a customer's site where the GD825A-2 was operated, we could create the durability standard of a motor grader suitable for mining. Based on the new standard with the new higher durability target, we designed the structure such as frames and the power train to realize the improved durability.

(4) Lightening weight

When newly developing a large vehicle, lightening weight is also important. If the size is made larger from the conventional model by using simple similarity design and a necessary strength is given, the weight of the vehicle increases too much mechanically. With the GD955-7, non-similarity design is used for many devices for lightening weight, which made all of the size, the weight, and the strength of the vehicle possible. The frame structures are shown below as examples.

Front frame structure: The rigid frame resistant to bending and torsion is designed with a large cross section structure using high-tensile steel boards, a simplified structure, and optimized plate thickness. It realizes two-times longer durability compared to the conventional model.

Rear frame structure: With the adoption of “the U-shaped cross section structure” using high-tensile steel boards, the light-weight, durable frame is realized. By optimizing the layout of the power line, the maintainability is significantly improved compared to the GD825A-2.



Fig. 4 Frame structure

3.1.2 Increasing engine output

Increasing the engine output in proportion to the extension of the blade width may bring the same work speed, but for a sufficient way for the anticipated working capacity improvement, we largely increased the engine output. Together with optimizing the gear ratio, we increased the matching travel speed during operation to improve the production.

3.2 Improved availability

3.2.1 Adoption of bearing type circle

With the GD955-7, Komatsu adopted “bearing type circle” which is superior in transmission efficiency, response, and durability for the first time. While “suspended circle” adopted with the GD825A-2 requires adjustment and replacement of the wear plates, the bearing type circle does not have consumable parts such as the wear plate, so that no adjustment or replacement is necessary. In addition, the auto-greasing mounted as standard makes all maintenance work related to the circle unnecessary.

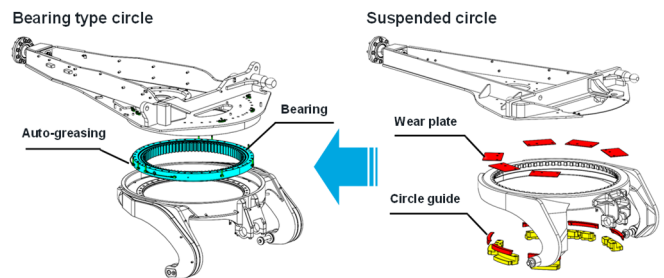


Fig. 5 Comparison of circle structures

3.2.2 Improved removal and installation of components

Similar to the middle or small sized motor graders, the cab is mounted on the front frame, so that the transmission can be removed or installed without dismounting the cab. The engine and the transmission which are usually mounted as a unit in the grader have the propeller shaft connection. This makes their separation easier, reducing the downtime.

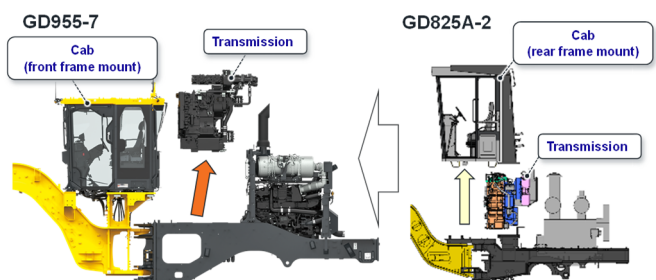


Fig. 6 Improvement of removal or installation of the transmission

3.2.3 Adjustable blade rail guide

The GD955-7 has the adjustment bolt mechanism in the blade rail guide additionally. This makes the sim adjustment required with the GD825A-2 unnecessary, enabling the adjustment using the bolts in a short time.

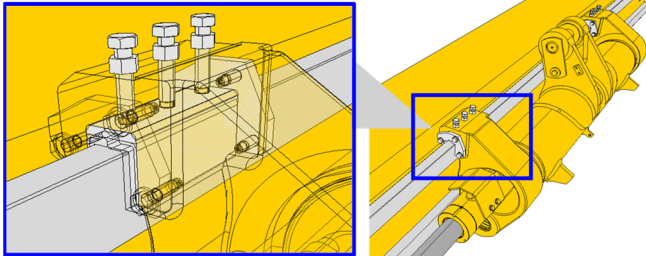


Fig. 7 Adjustment bolt mechanism

3.3 Improved safety and comfort

3.3.1 Cab design with security and safety

“The square cab” with separate ROPS mounted on GD825A-2 has changed to “the visibility-improving hexagonal ROPS cab” for the GD955-7. In the square cab, the view during operation is interfered by the A pillar and the front corner of the floor. However, “the adoption of electric levers” and “the adoption of the view-improving hexagonal ROPS cab” have achieved the best visibility. Also, “the additional mirrors” and “KomVision” assure safety confirmation from the operator’s seat. This design provides safe operation in mining sites which require high safety.



Fig. 8 View during operation

3.3.2 Adoption of electric levers

By changing the lever type from mechanical to electric, the work equipment control lever became able to be laid out with a great freedom. The work equipment control levers are located at both sides of the operator’s seat, which realizes “improved visibility during operation” and “improved comfortableness” at the same time. In addition to the steering wheel for travel, locating the electric steering lever for work near the left work equipment control lever makes the operation of the steering lever and the work equipment control lever at the same time easier, which significantly reduces the number of times of changing levers to operate compared to the GD825A-2.

(Maximal 92% reduction of hands movement)

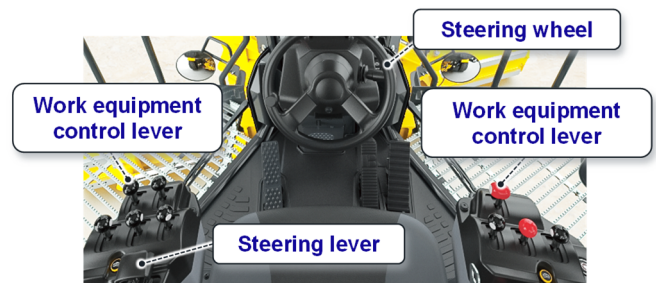
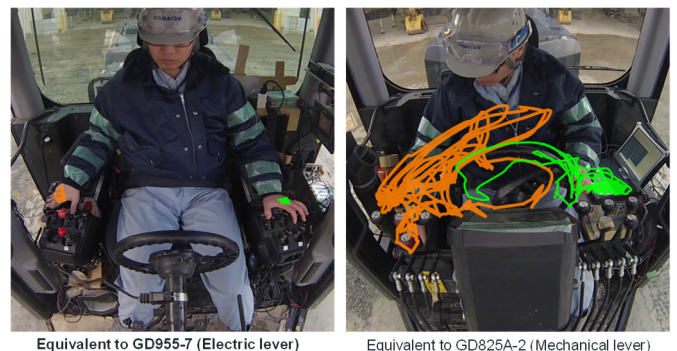


Fig. 9 Layout of levers



Equivalent to GD955-7 (Electric lever) Equivalent to GD825A-2 (Mechanical lever)

Fig. 10 Comparison of movements of operator’s hands

3.3.3 KomVision system mounted

The new model is equipped with the 5-camera, 5-radar KomVision (optional). The operator can check the vicinity of the vehicle 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 in low speed travel such as at starting, around a loading site, an oil station, or a maintenance shop, to take collision avoidance actions and damage mitigation measures.

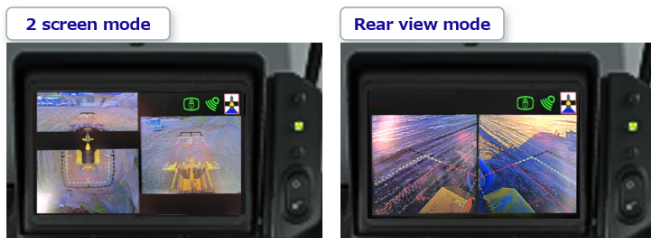


Fig. 11 KomVision monitor

3.3.4 Improved accessibility

As the vehicle classification is raised, the position of the cab becomes higher, which makes going up and down to/from the cab a little hard. "The rear entry specification" allowing an easy access from the rear is provided as an option.



Fig. 12 Access path

3.3.5 LED lamps equipped as standard

LED lamps are used for the head lamps, working lamps, turn signal lamps, and the rear combination lamps as standard for long service life, excellent visibility, and economic efficiency. By examining the night-time visibility with the analysis software, the optimum lamp layout with the consideration of light reflection has been accomplished.



Fig. 13 Night-time operation

3.4 Improved maintainability and standardized mining equipment

3.4.1 Auto-greasing

The auto-greasing strongly requested to be attached in factory is equipped as standard. All the greasing points are automatically greased. Troublesome greasing work to many points is now unnecessary.



Fig. 14 Auto-greasing tank and greasing inlet (on the work equipment)

3.4.2 Service center

The ports of lubrication and water for engine oil, transmission oil, coolant, and hydraulic oil are collectively arranged at the position where maintenance is possible from the ground level for easy replacement.



Fig. 15 Service center

3.4.3 Sampling ports

The exclusive ports for oil sampling for vehicle condition check are installed. Engine oil, transmission oil, hydraulic oil, and axle oil are pressurized, so they can easily be collected without pumping.

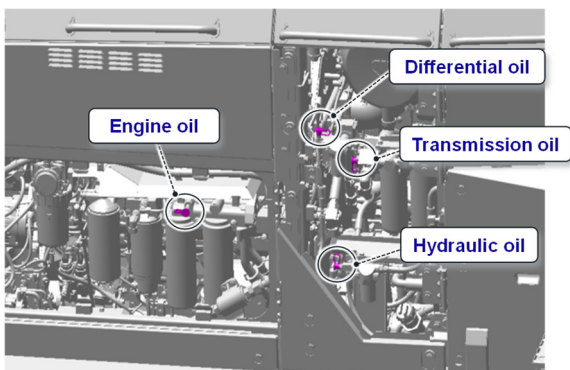


Fig. 16 Sampling ports

3.4.4 Disconnect switch

The battery disconnect switch and the starter disconnect switch are provided as standard for improving the safety during the maintenance. These switches are located around the articulate hinge on the left side of the vehicle to provide an easy access from the ground level.

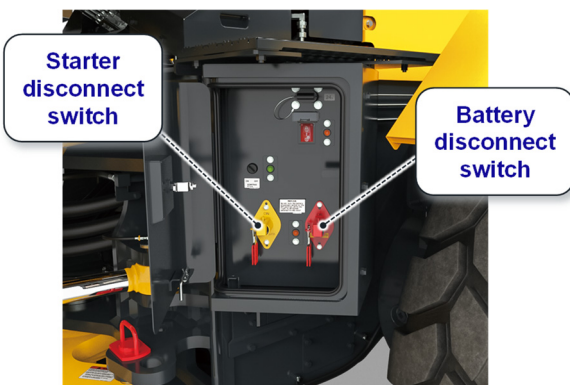


Fig. 17 Disconnect switch box

3.4.5 Vehicle management by Komtrax Plus

“Komtrax Plus” which is the management system mounted on large-sized machines for mining is mounted on the motor grader for the first time. The pressure sensor is added to the work equipment cylinders to grasp the work type and the operation condition. By the satellite communication, “health condition” and “operation condition” of the vehicle are easily grasped even from remote locations. It contributes to preventive measures for machine troubles and efficient vehicle management together.

3.4.6 Collective filters layout

The main filters are collectively laid out inside of the service door on the right side of the vehicle to reduce the person’s moving distance during the service operation and provide easy filter replacement.



*KCCV: Komatsu Closed Crankcase Ventilation

Fig. 18 Layout of filters

3.4.7 Wet type parking brake

The parking brake is changed from “the dry type disc brake” using air which had troubles to “the wet type multiple disc brake” used for the service brake as well. The brake capacity and the reliability have been improved and made it maintenance-free.

4. Conclusion

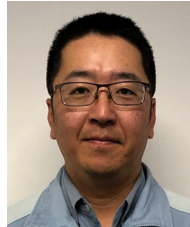
We developed this vehicle as Komatsu's first motor grader exclusive for mining. We continued to have discussions for its product concept as well as its quality confirmation methods with our relevant departments. After going through hard challenges, we finally accomplished the vehicle which satisfies not only the regulations but also the performance, the durability and the equipment required in mining sites. We believe that this vehicle will be more evaluated and be used longer by customers than the conventional model. Currently, the vehicle of the first production has been introduced in a gold mine in Canada and it is operating steadily. We would like to continue to support customers to satisfy them and build trust with them.

Introduction of the authors



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[A comment from the authors]

We proceeded with the development of this vehicle with a lot of support in design from VDC3 (Awazu Plant). I would like to thank the designers who completed the five-year design work in VDC1 (Ibaraki Plant) with many difficulties and their families. Almost all of the parts of this vehicle were newly designed. Thanks to the cooperation and support from many departments throughout its development processes from prototype model to mass-production model, we have successfully accomplished the project. We thank not only the staff of the development and production departments but all people involved in this development.