

Introduction of Products

Introduction of Bulldozers D155AX-8/AXi-8

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The new bulldozers, D155AX-8/AXi-8, inheritor of the excellent fuel consumption efficiency of high performance bulldozers, D155AX-6 and D155AX-7 developed under the concept of “environment”, “safety” and “ICT”, have been developed and launched to the market. D155AX-8/AXi-8 conforms to the 4th exhaust gas regulations, is environmentally-friendly and secure maximum user profits. This report introduces the main features of the new models.

Key Words: *Bulldozer, Exhaust Gas Regulations, ICT Construction, intelligent Machine Control, Sigmadozer, Automatic Gear Shift, Lock-up, Auto Idle Stop, Ripper Auto Return, Auto Pitch*

1. Introduction

The current D155AX-7 conforms to the 4th exhaust gas regulations (EPA Tier4 Interim and so on) and its excellent fuel economy, productivity and durability, and economy are highly rated in the market. This time, more stringent exhaust gas regulations have come into effect in Japan, U.S. and Europe. The large-sized bulldozer, D155AX-8 (**Fig. 1**) which is installed with a new engine conforming to Japanese 2014 Off Road Law, North American EPA Tier4 Final and EU StageIV and inherits current excellent performance, and D155AXi-8 (**Fig. 2**), an ICT construction machine which attracts attention recently, to which function, not found in after-market products, is added by cooperation with TOPCON have been developed and launched on the market. Their features are introduced below.



Fig. 1 External view of Komatsu D155AX-8



Fig. 2 External view of Komatsu D155AXi-8

2. Development Objectives

The concept is development of products which conform to the 4th exhaust gas regulations, inherit excellent fuel consumption efficiency established with D155AX-6/7, are environmentally-friendly, and secure maximum user profits. Based on “Quality and Reliability”, the product competitiveness has been substantially increased, conforming to environmental regulations and utilizing ICT technologies. Features incorporated into D155AX-8/AXi-8 are as follows.

2.1 New items

- 1) Installation of the engine which conforms to Japanese, US and European 4th exhaust gas regulations (Tier4 Final)
- 2) Renewal of exterior design
- 3) Adoption of auto idle stop function
- 4) Adoption of ripper auto return
- 5) Adoption of PLUS
- 6) Adoption of intelligent Machine Control

2.2 Main inherited items from D155AX-6/D155AX-7

- 1) Adoption of Sigmadozer
- 2) Automatic gear shift powerline with lock-up
- 3) Support for reduction in fuel consumption by ECO guidance
- 4) Adoption of high-resolution 7-inch LCD monitor
- 5) Expansion of KOMTRAX information

3. Main Features

- (1) Engine which conforms to Japanese, US and European 4th exhaust gas regulation.

The amount of emission of NOx (nitrogen oxides) and PM (particulate matter) has been considerably reduced by mounting a new generation engine “Komatsu SAA6D140E-7” combining our unique technologies which have been accumulated for long years, and this new model has passed the 2014 Off Road Law. New technologies adopted for this engine (**Fig. 3**) are introduced below.

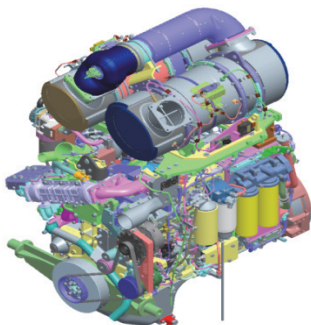


Fig. 3 External view of engine

- 1) Combustion system

The electronically controlled common rail fuel injection system with maximum injection pressure of 200 MPa and the new combustion chamber, both originally introduced on the Tier4 Interim engines, have been retained on the new engines, which were then tuned for maximum performance.

Despite adding the urea selective catalytic reduction system in the aftertreatment system, an amount of fuel consumption (diesel + urea water) equal to or less than that of conventional machines could be achieved even in consideration of an amount of urea water consumed.

- 2) Aftertreatment system

For the engine which conforms to the Tier4 Interim exhaust gas regulations, we have developed the Komatsu Diesel Particulate Filter to capture and remove soot in exhaust gas.

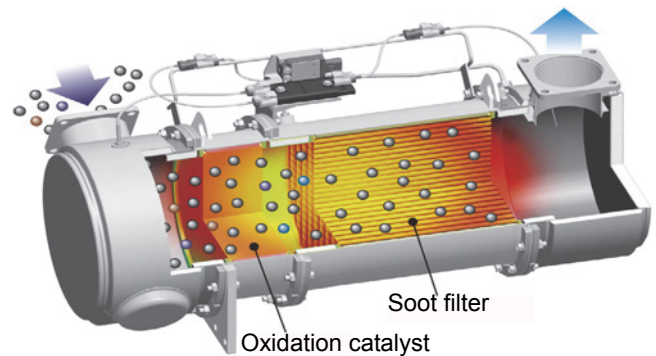


Fig. 4 Komatsu Diesel Particulate Filter

To meet the Tier4 Final exhaust gas regulations, Urea Selective Catalytic Reduction System which reduces NOx emitted from the engine to 1/5 or less is newly installed in addition to the Komatsu Diesel Particulate Filter.

This system decomposes NOx in the exhaust gas into harmless nitrogen (N₂) and water (H₂O).

As shown in **Fig. 5**, urea water is injected into exhaust gas, and NOx reacts with ammonia in the solution within the selective catalytic reduction catalyst and is broken down into nitrogen and water.

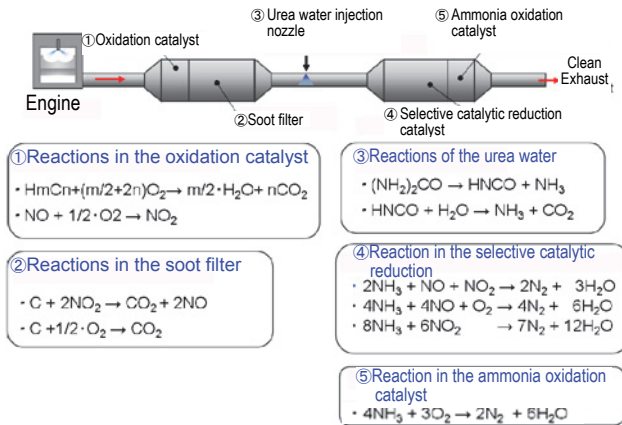


Fig. 5 Chemical reaction of NOx reduction

As shown in Fig. 6, this system is broadly composed of the urea water distribution system which injects urea water into exhaust gas, the urea water mixing line which decomposes injected urea water into ammonia and disperses it in exhaust gas and the selective catalytic reduction assembly with a built-in catalyst which promotes decomposition reaction of NOx.

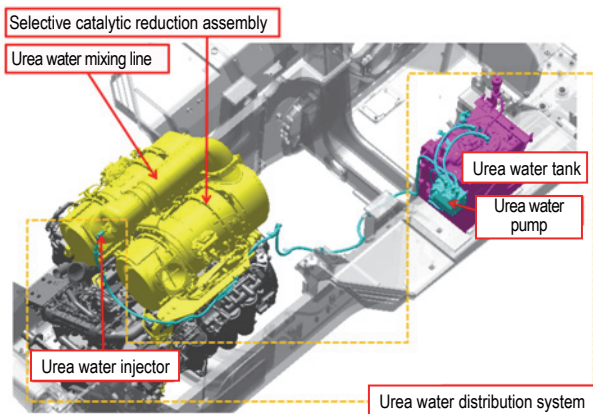


Fig. 6 Urea selective catalytic reduction

① Urea water distribution system

The urea water distribution system is composed of a urea water tank, urea water pump and urea water injector.

Urea water is pressurized by the urea water pump and is injected by the urea water injector into exhaust gas by the urea water injector. If an amount of urea water injected is too little, NOx is not sufficiently decomposed, resulting in an increase of NOx emitted. On the other hand, if an amount of urea water is too much, deposits of urea is formed inside the exhaust pipe or excess ammonia which is not used for decomposition of NOx is discharged. While a construction machine is in operation, engine speed or output constantly fluctuates according to a load of the machine and thus, an amount of NOx in exhaust gas also changes constantly. The

Urea water distribution system is equipped with a control system which monitors an operating condition of the engine and a condition of the selective catalytic reduction assembly and can always inject a proper amount of urea water.

The urea water freezes at -11°C. In construction machines which operate in the low temperature environment, thawing and heat keeping functions of urea water are essential to actuate this system. To be able to thaw the solution or keep it warm with respect to the surrounding temperature, a urea water hose for connection piping of each device of the urea water tank and pump has built-in heater wire.

② Urea water mixing line

In the Urea water mixing line, urea water which is injected into exhaust gas is decomposed into ammonia before it reaches the catalyst and is uniformly dispersed in exhaust gas. If the internal structure is made complicated to disperse ammonia uniformly, deposits of urea can be formed in the internal structure. The internal structure of the urea water mixing line is optimally designed utilizing CFD flow analysis so that ammonia can be uniformly dispersed efficiently in a limited space of a construction machine. Fig. 7 shows an analysis example of urea water mixing line.

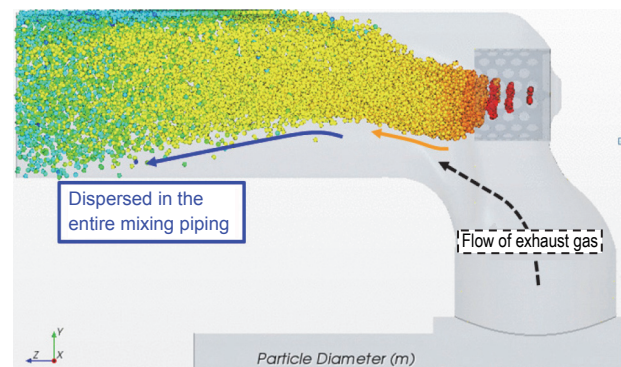


Fig. 7 Analysis example of Urea water mixing line

③ Selective catalytic reduction assembly

The selective catalytic reduction assembly has a built-in the selective catalytic reduction catalyst which allows NOx in the exhaust gas and ammonia generated through the dissolution of urea water to react with each other and facilitates the dissolution of the NOx into harmless nitrogen and water. In the reaction process, ammonia is adsorbed in the catalyst and adsorbed ammonia reacts with NOx in the exhaust gas. (Fig. 8) Therefore, more NOx can be decomposed by adsorbing a lot of ammonia in the catalyst. Installed sensors always monitor a condition of the assembly during operation of a machine, assume an amount of ammonia adsorbed in the catalyst and determine the optimal injection amount of urea water to supply necessary ammonia according to an amount of ammonia

consumed in the catalyst and an amount of NOx flowing from the engine.

An ammonia oxidation catalyst is arranged in the downstream of the catalyst to prevent excess ammonia from being discharged in the atmosphere from the exhaust pipe.

As with oxidation catalysts and soot filter in the Komatsu Diesel Particulate Filter, these catalysts are supported on a ceramic substrates, which are held in place by a mat made of special fiber with high heat resistance and is built in a metal casing. This type of structure is similar to that of the Komatsu Diesel Particulate Filter which has market-proven records from 2011 and has sufficient reliability and durability even in the severe, shock load-prone operating environment of construction equipment.

Fig. 9 shows internal structure of the assembly.

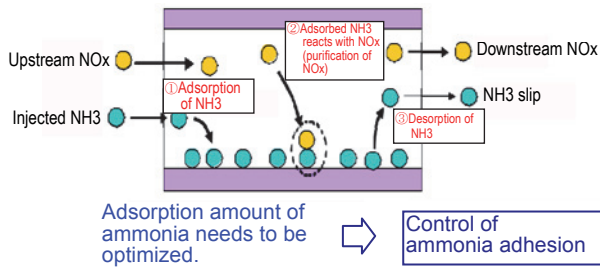


Fig. 8 NOx reduction of catalyst

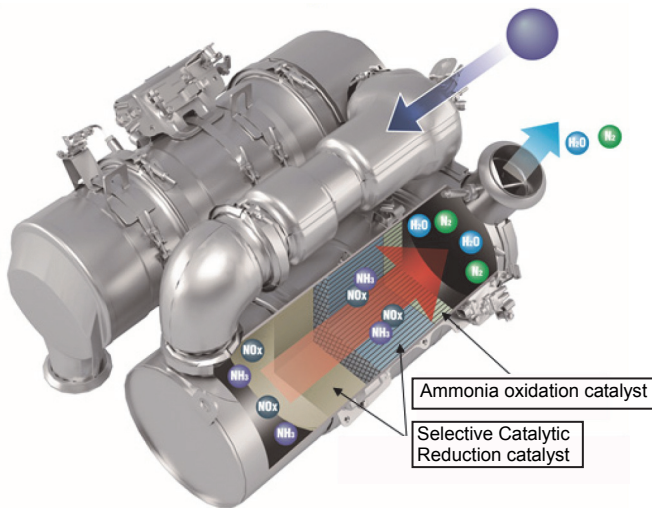


Fig. 9 Internal structure of assembly

In an operating condition of construction equipment, load frequency is high compared to commercial vehicles and passenger cars and exhaust gas temperature tends to be high. Various chemical reactions with an aftertreatment system are more likely to be promoted. The Komatsu Diesel Particulate Filter, urea water mixing line and selective catalytic reduction assembly developed this time prevent a temperature decrease inside with heat insulating structure, effectively utilize high

exhaust gas temperature and can suppress a decrease in function to the minimum with respect to operation under light load or a decrease in exhaust gas temperature due to operation in the low temperature environment. As is seen from the above, these are optimally designed for installation in construction equipment.

The Komatsu Diesel Particulate Filter, urea water mixing line and selective catalytic reduction assembly are all manufactured at Komatsu to ensure high quality.

(2) Exterior design

With “Tough & Powerful” as a design concept, the overall machine shape is designed so that it looks larger and more powerful. The shape of hood and fuel tank are designed to ensure operator’s view.



Fig. 10 Exterior design

The hood design is shown in Fig. 11. Although it has greater volume compared to that of conventional machines, operator’s front view is secured.



Fig. 11 Hood design

The fuel tank design is shown in **Fig. 12**.

The tank has higher overall height and largely projected shape compared to conventional machines. However, hollow structure is provided in the center of the tank so that visibility of the ripper point is secured.

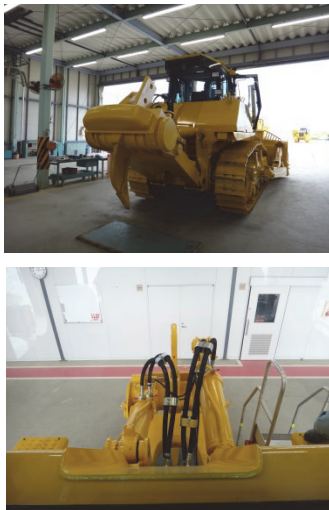


Fig. 12 Fuel tank design

The design of the cab-mounted condenser for air conditioner is shown in **Fig. 13**. Clogging is less likely to occur because the condenser is separated from the cooling assembly and is mounted on the rear upper part of the cab. Cooling air inlet is located on the underside of the condenser and the outlet is on the rearward in consideration of snow in winter.



Fig. 13 Air conditioner condenser

The filler port of urea water is shown in **Fig. 14**. The filler port is provided at the front end of the left fender so that the bag in box type urea water can be easily moved and used.



Fig. 14 Filler port of urea water

(3) Auto idle stop

When there is no movement or no operation of work equipment and an idle state continues, the engine is automatically stopped to suppress unnecessary emission of exhaust gas in consideration of the environment.

The time until activation of idle stop is set, at the time of shipment from the plant, matching the time stipulated in the regulation for areas having the regulation. For areas having no regulation, machines are shipped in a state in which the time can be set.

(4) Ripper auto return

Lifting operation and tilt back operation during ripper operation are enabled by one lever operation. This function reduces operator's burden during ripper operation.

■ **During rearward travel:** When the ripper lever is operated to the lifting side once, then, ripper lifting operation and tilt back operation are automatically performed.

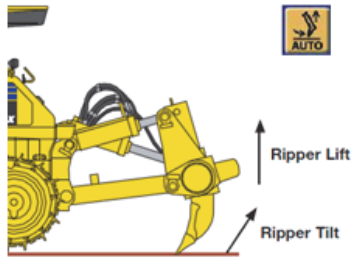


Fig. 15 Example) Ripper auto return



Fig. 17 Roof top antenna

(5) PLUS

Undercarriage system with rotary bushing PLUS (Parallel Link Undercarriage System), which has been adopted for small-sized models, has been made available for D155 as option. This can substantially reduce repair and maintenance costs of the crawlers and sprockets which account for more than 20% of the repair and maintenance costs in bulldozers.

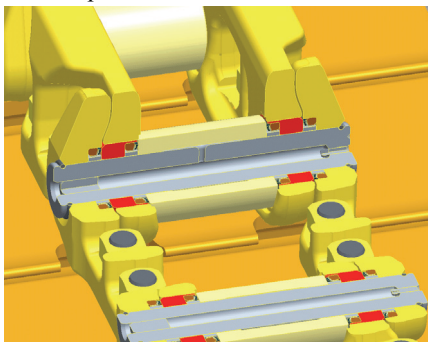


Fig. 16 Structure of PLUS

(6) Intelligent Machine Control

The ICT construction market utilizing GNSS has been rapidly expanding because cost merits of users (shortening of construction period, substantial reduction in finishing stake, reduction in labor costs) are great.

This time, we have developed the intelligent Machine Control specification to further enhance work efficiency and to expand cost merits of users by integrating our machine body control with blade control of TOPCON. This specification is marketed as D155AXi-8.

The adoption of a roof top antenna (Fig. 17) has eliminated the need for an unstable antenna pole, improving the reliability.

This model adapts to heavy-load operation conventional after-market products could not handle. It can perform a series of operation from heavy-load digging operation, which is often performed by large-sized bulldozers, to finish grading operation with automatic control (Fig. 18). We believe that this machine can contribute to improve finishing accuracy and to shorten work time. Moreover it can be contribute to solve a problem of reduction in the number of skilled operators which has become evident in recent years.

Auto Blade Control : First To Last Pass
Improved Productivity, Finish Grade Performance

Rough dozing

1. As the blade load reaches a preset level...
2. The blade automatically raises to minimize track slip.
3. The blade can also lower to push as much as possible.

Finish grading

Continue from rough dozing to finish grading automatically once target grade is approached.

Seamless Operation
Dozer automatically shifts from "Rough dozing" to "Finish grading" when it comes close to the target surface.

Fig. 18 Possible from heavy-load digging operation to finish grading

Furthermore, this specification is adaptable to the construction management system, sitelink3D (Fig. 19) made by TOPCON and can contribute to the efficiency improvement of the entire construction site.

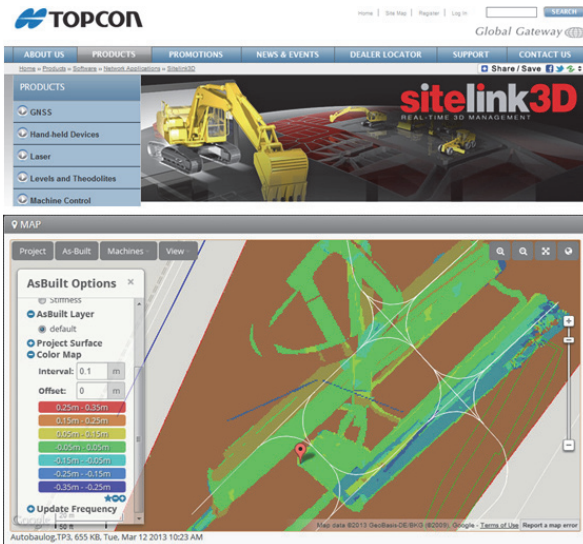


Fig. 19 Screen of Sitelink3D

4. Conclusion

We have introduced our large-sized bulldozers “D155AX-8/AXi-8” with emphasis on new features.

We are self-confident that we have developed machines which satisfy customers by achieving the challenge of conforming to the exhaust gas regulations as well as by advancing other points.

We are daily tackling research and development always to advance with “Environment”, “Safety” and “ICT” as three main themes, and are committed to making efforts to promptly responding to various regulations and market needs so that our machines are indispensable to customers.

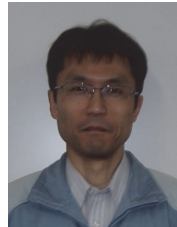
Introduction of the writers



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[A few words from writers]

The product has been finished attractively, meeting the exhaust gas regulations required by the society and also incorporating other features.

The bulldozers developed by the concerted efforts of not only Development and Production Departments but also all the related departments are going to be launched on the market, and this development would not have been achieved without the cooperation of the parties concerned. We would like to express our deep gratitude to all parties concerned.