

Introduction of Products

Self Propelled Wood Crusher GARA-PAGOS REFORE BR200T-3

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The Komatsu GARA-PAGOS Series machine equipped with a wood crusher will be remodeled as Model 3, for the first time in 14 years since the release of the current, Model 2, in 2006, in conformity with the 2014 Japanese standard for exhaust gas from domestic non-road machines. Model 3 has incorporated the installation of a dust collector, safety, and improved usability as well as the conformity with the exhaust gas regulations. This paper introduces its main features.

Key Words: GARA-PAGOS, REFORE, exhaust gas regulations, wood crushing, cyclone, dust collector, tub, mill

1. Introduction

The machine introduced herein is a member of the GARA-PAGOS Series, which Komatsu has been promoting as a self propelled resource recycling machine that conforming to the 2014 Japanese standard for exhaust gas from domestic non-road machines. Following the BR380JG-3, which crushes rocks and concrete, and the BZ210-3, which improves soil property by mixing with solidified materials, the BR200T-3, introduced herein, is a new model that crushes wood-based materials and turns them into chips. The previous model, BR200T-2, was for domestic marketing; without conformity with the third exhaust gas regulations, it was sold in a few exception cases. However, 100 units of this model were sold out by 2016, and thereafter, we were therefore unable to offer any new model to users.

In recent years, the need for this machine, which is a recycling machine, is steady also thanks to growing interest of society in environmental issues. Burning trees that have grown by absorbing carbon dioxide is the use of carbon neutral resources, which does not increase atmospheric carbon dioxide; this is also expected to increase the use of wood chips by biomass power plants. In addition, the reinforcement of legal restrictions such as prohibition of open burning, the enforcement of the construction recycling law, and the administrative trends such as new energy law and expansion of use of biomass fuel are also linked to demand for wood crushers.

We have developed a new model, GARA-PAGOS REFORE BR200T-3, utilizing the know-how and technology of not only the compliance to exhaust gas regulations but also of self propelled wood crusher cultivated from the previous models, BR200T-1 and BR200T-2. It is outlined below (**Fig. 1**).



Fig. 1 Appearance of BR200T-3

2. Aims of Development

(1) Latest environmental performance

This machine has complied with the 2014 Japanese standard for exhaust gas from domestic non-road machines.

(2) Inheriting highly evaluated performance and reliability in the previous model

Radiator reversing fan, loading from three directions, radio control function, etc.

(3) Latest safety and maintenance functions

Handrails for fall prevention, battery disconnect switch, secondary engine stop switch, cyclone type dust collector, engine room cleaning door, cleaning platform, dust chute under engine, etc.

(4) Latest ICT functions

KOMTRAX and 7-inch high definition liquid crystal monitor

(5) Support for security and trust

KOMATSU CARE

3. Selling Points

This section describes the selling points of BR200T-3, and the means.

3.1 Product Overview

BR200T-3 is a self propelled wood crusher that crushes construction-generated wood, remaining materials in forest lands, and general waste such as pruned branches of street or park trees into chips. The wood crushing flow is as shown in the figure below. Each object loaded on the tub by a loading machine such as a hydraulic excavator is sent to the upper part of the hammer mill by the rotation of the tub and is crushed.

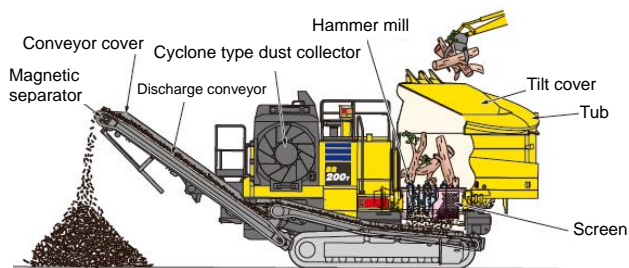


Fig. 2 Flow of crushed material

The hammer mill, which has a shape as shown in Fig. 3, consists of nine hammer rows each of which has an arrangement of one row of two bits on the circular shaft. Its rotation at a high speed allows objects of crushing (i.e. wood or branches) to be cut into fine chips while being shaved. At its bottom, the hammer mill has a fixed screen with a large number of holes (on a circular plate) along the periphery of rotation. The fineness of chips is adjustable by selecting the hole size.

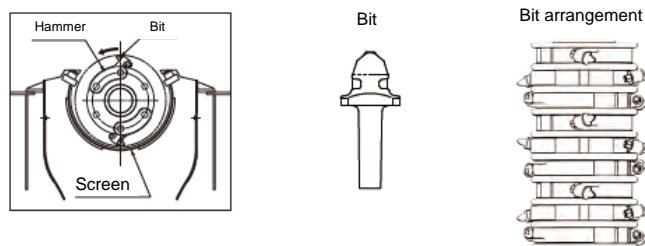


Fig. 3 Structure of hammer mill

The chips are discharged out of the machine with two belt conveyors installed at the bottom of the machine body. At this time, the head pulley integrated magnetic separator at the end of the discharge conveyor sorts out metals such as nails contained in an abandoned house or the like and separates them from product chips.

3.2 Environmental Performance

3.2.1 Engine

This machine is equipped with a self-developed clean diesel engine that satisfies the 2014 standards for exhausted gas. It is equipped with an exhausted gas aftertreatment system consisting of selective catalytic reduction (SCR) and Komatsu diesel particulate filter (KDPF), and by combining these, before emission it treats the gas into clean exhaust gas that suppresses the generation of NOx and PM.



Fig. 4 Exhaust gas aftertreatment system

The Adblue[®] tank, which supplies the Adblue[®] required for the operation of SCR, is installed near the control panel, which is easily accessible from the ground to perform the refilling or inspection.

3.3 Workability

3.3.1 Hammer mill

To exhibit the crushing performance, the machine should rotate the hammer mill at a high speed and suppress the decrease in rpm that is due to the crushing load. Therefore, by automatically performing the adjustment of the mill motor capacity and the wood supply on/off switching by reversing/stopping the tub, it suppresses the decrease in the rpm of the mill due to the crushing load, thereby keeping the crushing efficiency high. (Refer to Fig. 5)

Until now, Model 2 has adopted a system that drives one mill shaft with two hydraulic motors and uses one variable displacement motor to control the rpm and torque; however, this is complicated and costly. Model 3 has implemented the same principle with one large variable capacity motor (newly developed), achieving a simplified structure and improved durability.

Comparison between with and without variable control of mill motor (image)

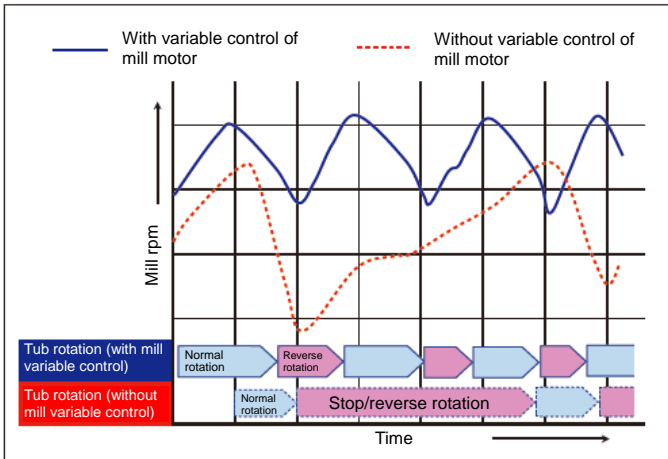


Fig. 5 Mill motor capacity variable control

In addition, the Hi mode has been set to increase the maximum rpm of the mill relative to the Model 2 so that it is available for a wider range of applications. For example, at a high rpm, the chips become finer and are used for bedding in cowsheds.

3.3.2 Work space layout

By placing the tub on the opposite side to the conveyor, the layout of the work space is made flexible, and the storage areas for raw materials and products can be selected separately and widely. In addition, the machine can be traveled by radio control even while working, and by traveling it while stacking chips, it can continue loading work without frequently removing piled chips.

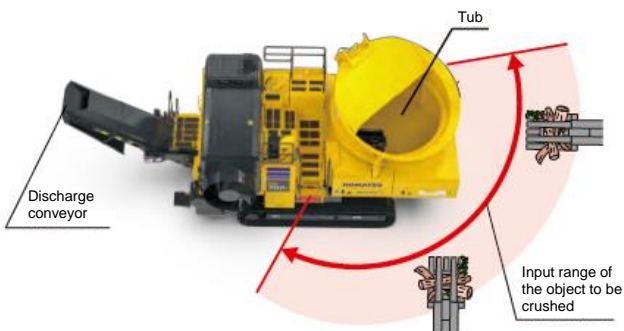


Fig. 6 Work space

3.3.3 Travel and transporting

As mentioned above, the machine traveling is by remote operation with a radio control device. Track shoe type undercarriage is adopted so that it can travel without stress even on uneven ground. For long-distance transport of the machine, its height can be 3,390 mm by loading it on a trailer with transport posture taken and can be transported on general

roads. For transportation, the only thing the user has to do is to remove the handrails and the tail tube of the engine without preparing a crane or the like.



Fig. 7 Dimensions for operation and transportation

For transportation, the machine cannot be directly loaded on the trailer because the cyclone type dust collector (detailed later) largely protrudes beyond the width of the machine body. For this reason, the left door including the cyclone collector is opened to the front of the machine to reduce the transporting machine width to 3 m or less. The opening operation can be performed without using any tool.



Fig. 8 Transport posture

3.4 Maintenance and Cleaning Performance

For wood crushers, it is inevitable that wood chips will float in the operating environment; however, they should be prevented as much as possible from entering hot sections of the machine body, especially in the engine compartment and from reducing the cooling efficiency by adhering to the cooling system. The user him/herself has to clean the machine daily so that wood chips will not accumulate in the machine body; easier cleaning has been demanded.

3.4.1 Cyclone type dust collector

Until now, the fan cooling the radiator has adopted a hydraulically driven mechanism that blows off dust such as wood chips adhered to the dust-proof net by reversing at regular intervals; Model 3 has followed this. The BR200T-3 is newly equipped with the cyclone type dust collector as an additional wood chip intrusion prevention mechanism. It uses a cooling fan to generate an eddying flow in the cooling air at the cyclone core, and separates and collects wood chips by the centrifugal force. It captures fine wood chips that can pass through the dust-proof net in front of the cooling system. The collected wood chips are stored in a dust box; the door under the box should be opened and discharged out of the machine once a day.



Dust box



Fig. 9 Cyclone type dust collector

3.4.2 Cleaning door and cleaning platform

On an ordinary construction machine, access to the engine is generally made with the hinged door (called the engine hood) opened at the top of the engine. The main purpose is to replace the filters, check the oil level, and perform other maintenance. To access the lower part of the engine, the undercover must be removed. To clean wood chips that accumulate in the engine compartment, especially at the bottom, we took quite a bit of work with the engine hood opened. Thus, two large cleaning doors were installed on the

front cover, in addition, steps and platforms have been added. This allows access not only from above the engine but also from the side, making it possible to easily clean the lower part of the engine while directly observing it. A part of the undercover is provided with a dust chute with an inclination. It is designed to push down wood chips, by jointly using the attached engine blower, from within the engine compartment from the top downward and discharge them to the side of the machine. The dust chute can be opened and closed from the ground without tools. These improvements in cleaning performance have halved the time of daily cleaning work relative to conventional machines. (Refer to Fig. 10)



Dust chute Cleaning door Step Cleaning platform



Dust chute



Cleaning image

Fig. 10 Cleaning door and platform

3.4.3 Torque wrench box

The hammer mill has 18 bits fixed with nuts. When worn out, they need to be replaced. The nuts can be installed and removed using an exclusively used torque wrench (standard tool). The effort required for the operator to move with heavy tools is minimized because the torque wrench box for storing it is located in the middle of the access path to the mill. The control panel for opening/closing the tub floor and for rotating and inching the mill is located right next to the wrench box; there is no waste in the operator's flow when opening the tub floor, taking the tool, and then performing the maintenance. In addition, inspection and cleaning around the work equipment can be easily performed by opening the tub floor, and the BR200T-3 is designed so that the handrails are left on the access path after opening, therefore, it can be got up/down more safely.

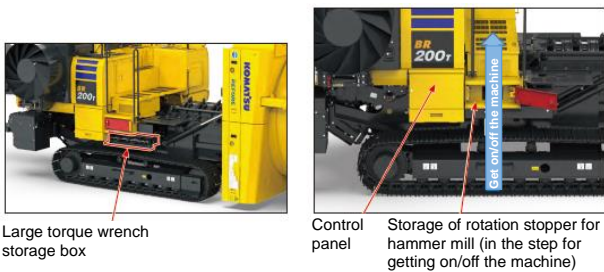


Fig. 11 Torque wrench box

3.4.4 Adblue® tank

The operation of SCR requires urea water (Adblue®), and frequent replenishment is indispensable like fuel. The BR200T-3 has a newly designed tank storage box installed on the front left side of the machine body and has a supply port at a position accessible from the ground. The machine has a back-in-box platform provided near the supply port, assuming that it is supplied in the back-in-box easily handleable even on worksite; therefore, you do not have to keep lifting it all the time during the refueling operation.

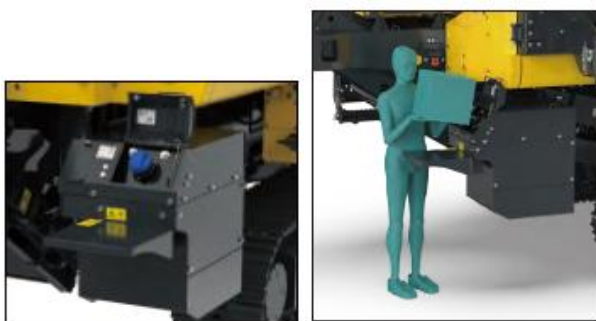


Fig. 12 Adblue® tank box

3.4.5 Radio control storage and power socket

The radio control transmitter, which can perform traveling work, opening/closing of the tilt cover, sounding the horn, and performing the emergency stop operation, can be stored in an independent radio control storage space below the control panel. During operation, the included battery charger can be used while using the power socket equipped to recharge the spare battery. On completion of operation, it can be locked with a machine key.



Fig. 13 Radio control storage space

3.5 Operability

3.5.1 Control panel and Radio control

The operation switches, concentrated on the control panel, can be operated safely and easily from the ground. Various sorts of setting and monitoring can be performed through the machine monitor installed on the control panel, and also if an abnormality occurs, the situation can be easily grasped. Mode switching (B: branch; T: trunk; R: root) allows the operator to select the optimum mode for the object to be crushed. They are used to preset the maximum rpm of the mill, the tub feed speed, etc. according to the object to be crushed. Other than this, by selecting the user mode (U), the rpm of the mill or tub can be set to the desired value. In addition, the Hi rpm is available for the mill in addition to the usual Lo rpm.

Self propelled crushers do not have an operator's seat, and the operator of the loading machine often operates the BR200T-3 during operation. For this reason, this machine comes with a radio control device as standard equipment, and the work and traveling can be easily performed by remote control. During operation, the operator can operate the tub or open/close the tilt cover from the loading machine, in addition, he/she can safely load and unload BR200T-3 on the trailer because the radio control device is operated to travel the machine without getting on it.



Fig. 14 Control panel and Radio control

3.5.2 High definition 7-inch LCD monitor

The liquid crystal monitor mounted on the control panel has the following features.



Fig. 15 High definition 7-inch LCD monitor

- 1) Compared to the previous model, the screen size has increased to 7 inches from 3.8 inches, and the screen has been upgraded to high-definition, thereby greatly improving the visibility.
- 2) The BR200T-3 uses a beautiful and conspicuous design using its exclusive graphics.
- 3) The crushing mode and travel speed selector switches are simply arranged on the monitor.
- 4) Without screen switching, the necessary information can be viewed, including fuelometer, Adblue® level gauge, work equipment operation status display, work mode display, hammer mill/tub speed selection, water temperature, oil temperature, fuel level, and tub open/close status.

- 5) The fuel consumption can be displayed hourly, daily, or in other form by using energy saving guidance.
- 6) The service meter can display values with a fraction part of one digit.
- 7) The fire prevention screen appears at key off time.

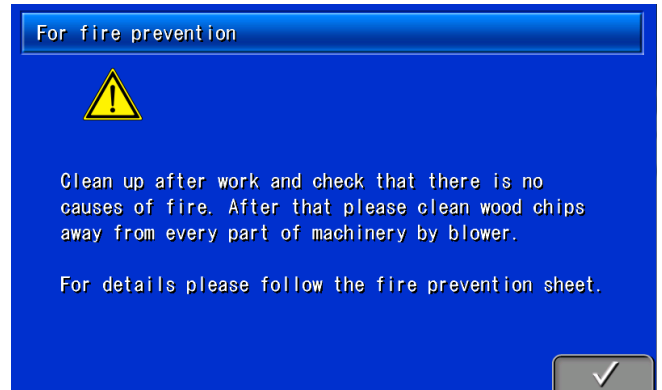


Fig. 16 Fire prevention screen

3.5.3 Rotation indicator (red/yellow)

The red or yellow rotation indicator lights up depending on the operation status of the work equipment. Each of the rotating lamps is newly equipped with a guard to prevent it from being damaged by flying wood.



Fig. 17 Rotation indicator lamp

- 1) Red lamp lighting condition
 - While the tub is reversed due to its overload
 - While the hammer mill rpm is lower than the specified value
 - During conveyor overload
- 2) Yellow lamp lighting conditions
 - When the preparation for operation of the radio control device is completed

3.6 Safety

3.6.1 Tub open/close limit switch

After access onto the hammer mill with the tub floor opened, this switch prevents the mill from rotating by mistake. Even when the tub is opened, the mill can be manually operated to reverse its rotation by pushbutton with inspection mode, but it stops by releasing the pushbutton.



Fig. 18 Tub open/close limit switch

3.6.2 Boarding prevention gate

The work equipment will not operate if you go up the step after opening the boarding prevention gate when climbing up to the machine body. The door knob of Model 3 was improved its usability by adopting the handle which is commonly equipped on other construction machines. In addition, its opening angle was enlarged.



Fig. 19 Boarding prevention gate

3.6.3 Machine tie off

On this model and the subsequent, as a resource recycling machine, anchor points are added as one for mill maintenance and one for conveyor piping replacement work. Anchoring the safety wiring harness can reduce the risk of injury that the worker may incur when he/she falls down from the machine during maintenance.



Fig. 20 Anchor points

Introduction of the authors

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Joined Komatsu Ltd. in 1992.
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[A comment from the authors]

This machine appeared about 14 years after the development of the previous model: due to delay in complying with exhaust gas regulations, our users experienced a long period during which Komatsu could not market no new model machine, and we received many requests for the development of a new-model vehicle.

I believe that the machine has succeeded in incorporating new designs that will please our customers, such as changing the mill drive system and adopting the new dust collector, while complying with exhaust gas regulations. Without being satisfied with this, I will continue to make use of market evaluations and requests for product improvements.

I would like to greatly thank the cooperating users, the Osaka Plant and other related departments inside and outside the company for their cooperation in developing this product.