

Introduction of Product

Introduction of PC27/30/35MR-3

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Compact excavators, models PC27/30/35MR-3, have been developed and introduced into the market based on the concepts of “environment,” “safety” and “IT,” which is common to Komatsu construction machinery. The background and technologies are described, and the new products are also explained.

Key Words: *Compact excavator, MR-3, exhaust gas regulation, safety, Interim Tier4, KOMTRAX, automatic travel transmission, tilt-up floor*

1. Introduction

Conventional machines MR-2 series were introduced into the market in 2003 and has enjoyed a high evaluation throughout the world including Europe, North America and Japan as the principal compact excavator models of Komatsu. Nevertheless, the time to comply with the exhaust gas regulations for small and midsize construction machinery, as well as for compact excavators, is fast approaching. In October 2007, the Off

Road Law was enforced in Japan and Interim Tier4 of the U.S. EPA will be implemented in 2008. Model change excavators (MR-3 series) that are compliant to these regulations and that incorporate enhanced product power have been developed. As the first models in the new series, PC27/30/35MR-3 was introduced into the market and the outlines are explained (**Photo 1**, **Table 1**).



Photo 1 Full view of PC30MR-3

Table 1 Principal specification

Item	Unit	PC27MR-3 <Canopy>	PC30MR-3 <Canopy>	PC35MR-3 <Canopy>	
Machine mass	kg	2750	2910	3350	
Rated output	kW/rpm	19.2/2600	21.4/2400	21.4/2400	
Standard bucket capacity (JIS)	m ³	0.08	0.09	0.11	
Travel speed	High	km/h	4.8	4.6	4.8
	Low	km/h	2.6	2.5	2.8
Max. excavation depth	mm	2550	2760	3110	
Max. excavation radius	mm	4650	5050	5300	

2. Objectives of Development

Continuing with the basic concepts of “environment,” “safety” and “IT” for the development of construction machinery of Komatsu, the following features were incorporated as selling points.

(1) Environment - An engine meeting U.S. EPA Interim Tier4 and Japanese Off Road Law* is equipped.

* Compliant to specifications of the Japan’s Ministry of Land, Infrastructure, Transport and Tourism for ultra-low noise construction machinery.

(2) Safety - 2-pillar ROPS canopy (roll-over protective structure CAB) and top guard installed as standard equipment* Meeting the world’s highest safety specifications Enhanced transportation.

(3) IT - KOMTRAX installed as standard equipment. (*: Installed beginning MR-2.)

Enhanced controllability and maintainability of work equipment such as higher speed are also incorporated.

3. Principal Selling Points and Accomplishment Means

The principal selling points of the PC27/30/35MR-3 incorporating the foregoing features and their means of accomplishment are described (Fig. 1).

3.1 Environment

3.1.1 Compliance with exhaust gas regulations

The MR-3 satisfies international exhaust gas regulations including those of Japan by equipping an engine that meets Interim Tier4 of the U.S. EPA, Stage III of the EU and the Japanese Off Road Law (Table 2).

Table 2 International exhaust gas regulations

Model Year	2006	2007	2008	2009	2010	2011
EU EU Directive sales date	Stagell (8.0/1.5/0.8)	Stagelll (7.5/0.6)				(NOx/HC/PM(smoke(%))>> (NOx+NMHC/PM) unit:g/kWh
18 ≤ P < 37						
NA US EPA production date	Tier2 (7.5/0.60)		Tier3 (Interim Tier4) (7.5/0.30)			(NOx+NMHC/PM) unit:g/kWh
19 ≤ P < 37						
JAPAN Off Road Law						(NOx/HC/PM(smoke(%))>> unit:g/kWh
19 ≤ P < 37				New Emission Regulation grace period (6.0/1.0/0.4/40)		

Accomplished by MR-2
Accomplished by MR-3

The principal changes made in the engine are shown in Fig. 2 and Table 3.

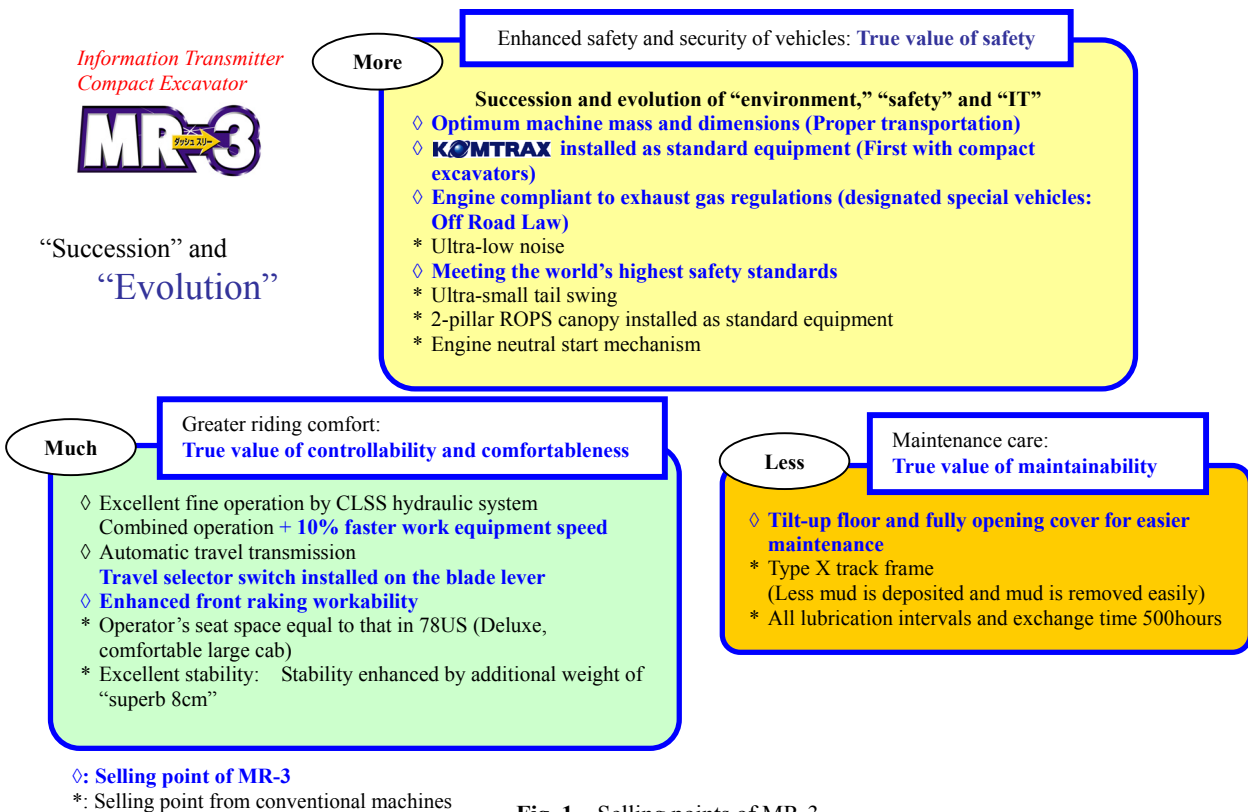


Fig. 1 Selling points of MR-3

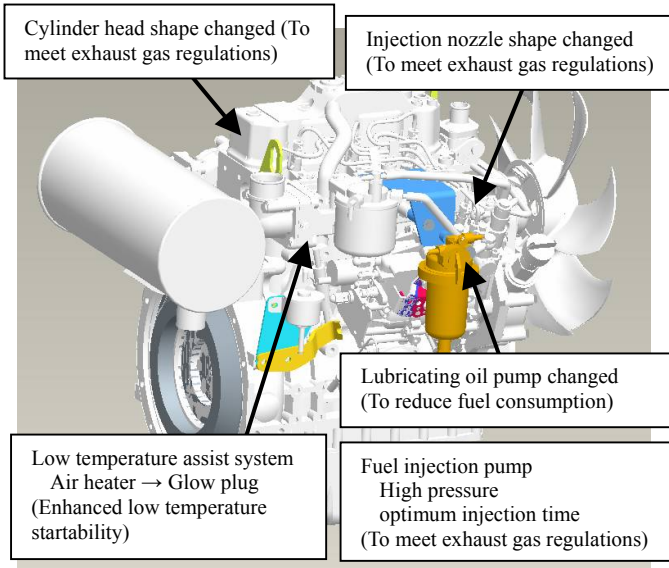


Fig. 2 Changes made in 3D88E engine as an example

Table 3 Engine specification

		PC30MR		PC35MR		
Model		MR-3 3D88E-6	MR-2 3D84E-5	MR-3 3D88E-6	MR-2 3D88E-5	
Specification	Combustion system	Water-cooled diesel direct injection	←	Water-cooled diesel direct injection	←	
	Cylinders	3	←	3	←	
	Bore diameter x stroke	mm 88 dia. x 90	84 dia. x 90	88 dia. x 90	←	
	Total displacement	CC 1642	1496	1642	←	
	Rated engine speed	rpm 2400	2500	2400	←	
	Rated output	kW(PS) 21.4(29.1)	20.6(28)	21.4(29.1)	21.7(29.5)	
Regulation	Japan	Exhaust gas	Off Road Law	Ministry of LITT exhaust gas Tier2	Off Road Law	Ministry of LITT exhaust gas Tier2
	North America		EPA Interim Tier4	EPA Tier2	EPA Interim Tier4	EPA Tier2
	Europe		EU Stage III	←	EU Stage III	←

* Ministry of LITT: Ministry of Land, Infrastructure, Transport and Tourism

3.2 Safety

3.2.1 Pursuit of safety

To meet safety standards and regulations, in addition to the safety structure of a 2-pillar ROPS and head guard (meeting Top Guard Level 1) canopy and ROPS head guard cab installed on the compact excavators, the following safety accessories that meet the EU safety regulations, which are the highest safety standards in the world, are installed on the MR-3 as standard equipment to achieve enhanced safety (Photo 2, Fig. 3).

- (1) Accumulator is installed for emergency grounding of work equipment when the engine is stopped.
- (2) A cover is installed on the high-pressure hose to prevent splashing of pressurized oil.
- (3) 12V external power outlets are installed for maintenance work at night.
- (4) Reflector seals position on the rear left and right of the excavators is installed for easy recognition at night.
- (5) Heater of outer air induction type is adopted to prevent the windows of the cab fogging.
- (6) Rearview mirrors are installed to ensure rearward visibility.



Cover to prevent splashing of pressurized oil



Rearview mirrors

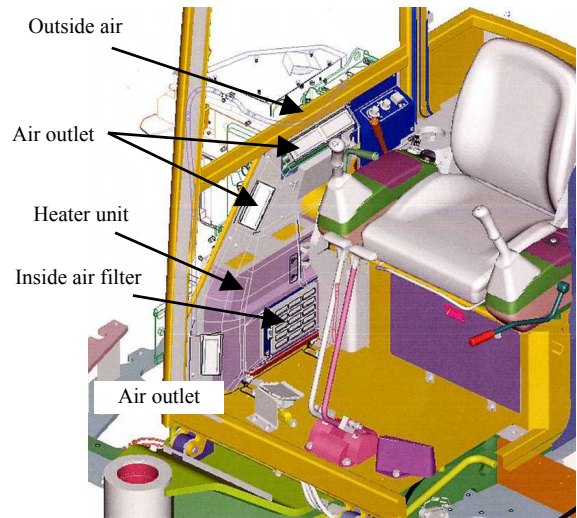


Reflector seals for recognition at night



12V external power outlets

Photo 2 Installation of safety accessories (Example 1)



Heater with induced outside air

Fig. 3 Installation of safety accessories (Example 2)

These measures are intended to enhance the product power by significantly enhancing safety and adding value in the resale market of used construction machinery.

3.2.2 Enhanced transportation - Reduced machine mass

The machine mass of the MR-3 series has been reduced by partially reviewing the machine body structure and work range to address the needs for proper transportation, which has become increasingly important recently (Table 4).

In the case of the 3-ton series, the PC30MR- was made to reliably transport a canopy of the standard specification on a 3-ton machine. As in the PC30MR, the machine mass was reduced so that the PC27MR can be recommended for 3-ton machines and the PC35MR, for 4-ton machines, when 1ATT piping, 4-way directional control valve and reinforced arms that are commonly required on rental construction machineries are installed. The machine mass of the PC35MR was reduced while maintaining stability by moving the upper structure 65mm backward. At the same time, jutting out of the counterweight in the existing machines was lessened for improvement and their appearance quality was enhanced (Fig. 4).

Table 4 Reduction in machine mass

Item	Unit	PC30MR		PC35MR		
		MR-3	MR-2	MR-3	MR-2	
Machine mass	<Canopy>	kg	2910	3140	3350	3580
	CAB	kg	3060	3255	3500	3755
Max. excavation depth	mm	2760	2910	3110	3170	
Max. excavation radius	mm	5050	5150	5300	5360	

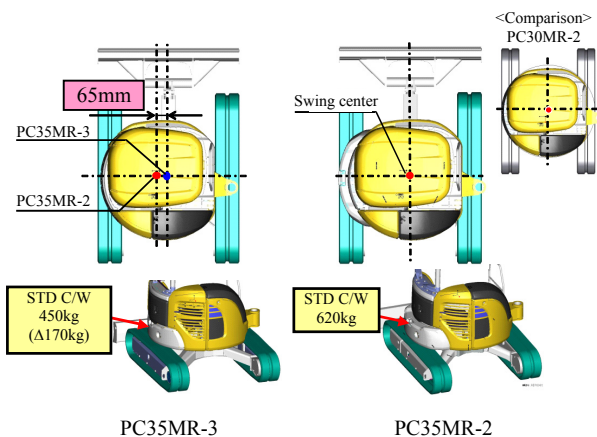


Fig. 4 Lightweight by moving the upper structure backward

3.3 IT

3.3.1 Installation of KOMTRAX as standard equipment

For the first time in the compact excavator industry, PC27/

30/35MR-3 have KOMTRAX installed as standard equipment to differentiate them from competitor products by incorporating the information technology (Table 5).

The principal functions of KOMTRAX for compact excavators are as follows.

- (1) Machine position can be checked in real time on a map using GPS.
- (2) Service meter information can be obtained in real time.
- (3) Fuel gauge information displayed on the monitor can be obtained.
- (4) Engine can be started and locked by remote operation.

Additionally, monitor caution information and water temperature gauge indication, as well as security information such as engine start and operation at night by e-mail transmission can be obtained. These functions offer the following advantages to the user.

- Total management of machines including working management
- Theft insurance at lower rate

Table 5 Functions of KOMTRAX for compact excavators

	Compact excavator	Hydraulic excavator
Machine position	○	○
Service meter	○	○
Operating hour zone	○	○
Fuel gauge	○	○
Water temperature gauge	○	○
Caution information	○	○
Time-to-change information	Not available	○
Engine start and lock	○	○
E-mail transmission	○ (Security information)	○

Information can be ascertained in real time

} Application needed

3.4 Enhanced controllability and comfortable-ness

3.4.1 Faster work equipment speed

To meet market needs, the MR-3 has increased the individual speeds of the work equipment (boom and arms) by about 10% (Table 6).

As a result, the operator will immediately notice increased efficiency. The speed of combined operation such as rough plowing (finishing) has been increased dramatically, resulting in enhanced workability (Photo 3).

Table 6 Speed increase of work equipment

		Indicator (%)	PC30MR		PC35MR	
			MR-3	MR-2	MR-3	MR-2
Individual operation	Boom lifting time	Indicator (%)	88	100	90	100
	Arm unloading time	Indicator (%)	92	100	88	100
Combined operation	10-operation cycle time	second	40	50	41	51
	Rough plowing (finishing) work	Indicator (%)	80	100	80	100



Photo 3 Rough plowing (finishing) work



Change in installed position of automatic travel transmission switch



Enhanced front raking performance

Photo 4 Example of controllability enhancement incorporated

3.4.2 Enhanced controllability of automatic travel transmission

The selector switch to shift between Auto Shift 2 and Shift 1 Lock was relocated from the monitor panel to the blade lever for the automatic transmission function during work traveling (Photo 4). Through this relocation of the switch, a change can be made without taking the hand from the blade lever during pushing around by blade operation or during grading work, thereby enhancing the controllability in paving and other work, for which market needs are high.

3.4.3 Enhanced front raking work

The distance between the blade and bucket teeth was reviewed and the workability of front raking work has been enhanced (Photo 4).

3.5 Enhanced Maintainability

3.5.1 Increased opening height of tilt-up floor

In response to market requests to increase the opening of the tilt-up floor structure, which is highly evaluated for maintainability, in the design of MR-3, the opening height was increased 70mm to enhance the maintainability. The floor tilt structure was reexamined and was simplified to reduce the weight of the canopy pole backup stand (Fig. 5).

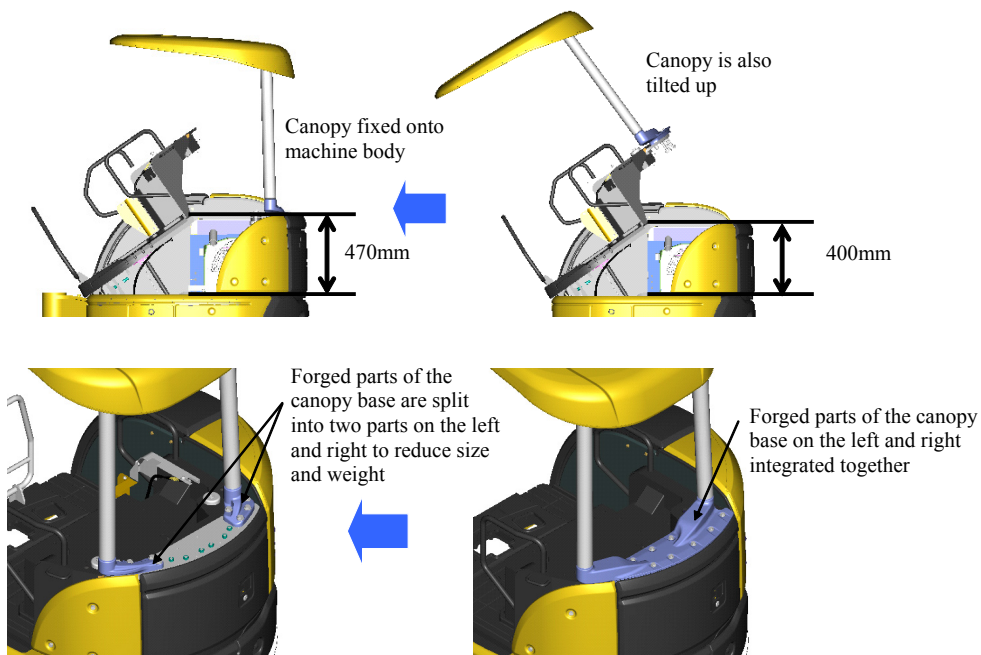
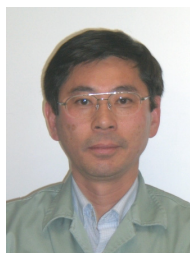


Fig. 5 Enlargement of floor tilt opening and simplified structure

4. Conclusion

Many competitor manufacturers are manufacturing compact excavators and competition is waged with manufacturers of non-construction machinery such as farming equipment manufacturers. The key to succeeding in this competitive situation is fast and efficient model changes that are cost competitive and have enhanced product power. The MR-3 series was developed to enhance the product power by evolving the development concept of the MR-2, which was popular because of its very clear selling points, even though meeting exhaust gas regulations was the main objective. Three 3-ton class models, PC27/30/35MR-3, were introduced into the market at first. Efforts will be made for an early lineup of the MR-3 series.

Introduction to the writer



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[A few words from the writer]

Compact excavators are roughly classified into three classes, namely, 1- to 2-ton class, 3-ton class and 4- to 5-ton class. Two or three models are sold in each class. In the development of the MR-3 series, three 3-ton class models were first developed simultaneously considering the global market scale. The delivery due date was set to meet the exhaust gas regulation timeframe. With considerable effort, the models were introduced into the market according to the planned schedule.

We plan to continue the evolution of the MR series to meet the changing needs of the global market.