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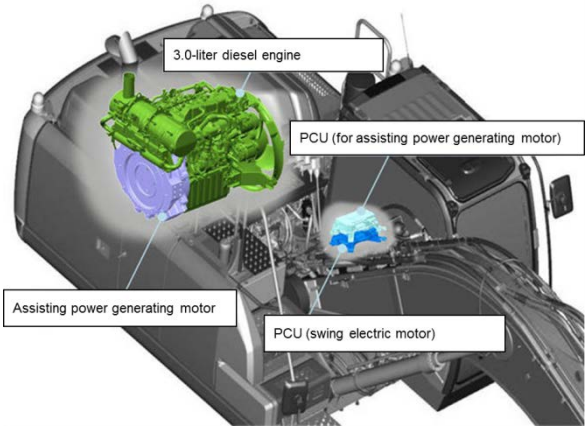
New Hybrid Unit Developed for Construction Machinery

—Installed on Hitachi Construction Machinery's hybrid hydraulic excavator ZH200-6—



Hybrid unit
New hybrid engine with integrated motor and PCU

Hybrid hydraulic excavator ZH200-6

Toyota Industries Corporation (President: Akira Onishi, "Toyota Industries") announces it has used its engine and power electronics technology in the industrial vehicle and automobile fields nurtured over the years to develop the company's first hybrid unit for construction machinery. This hybrid unit will be installed on the hybrid hydraulic excavator ZH200-6 (operating mass: 20.2 tons) from Hitachi Construction Machinery Co., Ltd. (President, Executive Officer and Director: Kotaro Hirano). The ZH200-6 will go on sale in September 2017, and conforms with Stage IV standards*[1], Etc. of Emissions from Non-road Special Motor Vehicles*[1].

It is said approximately 60% of the greenhouse gases emitted by Japan's construction machinery comes from hydraulic excavators*[2]. Against a backdrop of rising environmental consciousness and requirements for low fuel consumption among customers using construction machinery, demand is growing for hybrid hydraulic excavators with engines and motors. Hitachi Construction Machinery, the company adopting the hybrid unit this time, has shipped a cumulative total of more than 1,000 units within Japan.

Toyota Industries' newly developed hybrid unit comprises a new hybrid engine (with integrated motor)—combining a diesel engine with an assisting power generating motor—and a power control unit (PCU). The new hybrid engine (with integrated motor) is the world's first in the 74 kW-class[*3] to achieve Stage IV standards without using urea-SCR[*4]. Maintenance is significantly improved as there is no need to manage or refill AdBlue®. In addition, by combining with the newly developed high-power thin-type motor, it is possible to set the engine's optimal fuel efficiency in the area of high operating frequency, thereby achieving low fuel consumption. At the same time, the PCU controlling the motor is also capable of dealing with the unique operating environment of construction machinery, such as vibrations and being oil resistant, even as it utilizes power supply technologies for automobiles. Toyota Industries' newly developed hybrid unit significantly contributed to the new hybrid hydraulic excavator ZH200-6's achievement of the highest level of fuel efficiency performance[*5] within the industry.

Toyota Industries will continue to promote innovation in technologies related to energy and the environment so as to achieve an environmentally-friendly society, and contribute to the construction machinery field as well as the industrial vehicle and automobile fields.

【Main characteristics】

1. New hybrid engine (with integrated motor)

・Uses the 1KD engine, an engine which is used in automobiles in 157 countries and regions around the world, as well as in lift trucks since 2013
・First in the world in the 74 kW-class to achieve Stage IV standards without using urea SCR
・With the assistance of the motor, optimal fuel efficiency is set in the area of high operating frequency, thereby achieving low fuel consumption
・The motor has a low profile as it is directly linked to the engine, allowing it to be installed within the engine compartment of a 20-ton hybrid hydraulic excavator

Specifications	
System output	118 kW (2,000 min^{-1})
Dimensions (overall L × W × H)	1,162 mm × 946 mm × 1,087 mm
Weight	548 kg
Engine	
Engine Code	1KD
Engine type	4-cycle water-cooled
Cylinder type	Inline 4-cylinder
Total displacement	2,982 cc
Bore × stroke	96 mm × 103 mm
Fuel injection system	Common rail fuel injection system
Turbocharger	Electronically-controlled variable nozzle turbocharger
Exhaust aftertreatment	DOC[*6] + DPF[*7]
Maximum output (reference value)	74 kW (2,000 min^{-1})
Maximum torque (reference value)	390 Nm
Assisting power generating motor	
Motor type	Permanent magnet synchronous motor
Maximum output (reference value)	44 kW (2,000 min^{-1})
Maximum torque (reference value)	210 Nm

2. Motor control PCU

・Compact PCU utilizing technologies for automobile power supply equipment
・Uses a high-performance heat-dissipating compact cooler
・Uses highly-reliable electronic components for automobiles
・Developed for construction machinery, with anti-vibration characteristics improved, and oil resistance ensured

*1 Act on Regulation, Etc. of Emissions from Non-road Special Motor Vehicles..
*2 Source: New Energy and Industrial Technology Development Organization (NEDO)
*3 In the category of output above 56 kW and below 130 kW, based on Toyota Industries' own research
*4 Selective catalytic reduction for nitrogen oxide reduction
*5 Source: Ministry of Land, Infrastructure, Transport and Tourism
*6 Diesel oxidation catalyst
*7 Diesel particulate filter; catches and removes particles from exhaust gas

*Adblue® is a registered trademark of the VDA (Verband der Automobilindustrie).