

# Development of New Generation 3.3-Liter Clean Diesel Engine (Second Report)

-Cooperative control technology for a large-displacement strong engine, 48V mild hybrid and 8-speed transmission-

**Hiroataka Yamakawa<sup>1)</sup> Toru Kobayashi<sup>1)</sup> Akitomo Kume<sup>1)</sup> Hiroshi Minamoto<sup>1)</sup> Kentaro Takaki<sup>1)</sup>  
Takeru Matsuo<sup>1)</sup> Tadashi Saito<sup>1)</sup> Kotaro Takahashi<sup>1)</sup> Hiroaki Gotan<sup>1)</sup> Daigo Nishikori<sup>1)</sup>  
Hiroshi Shinozuka<sup>1)</sup> Daisuke Shimo<sup>1)</sup>**

*1) Mazda Motor Corporation  
3-1, Shinchi, Fuchu-cho, Aki-gun Hiroshima 730-8670, Japan.*

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The large displacement of a new 3.3-liter diesel engine brought about an expanded operating range of Premixed Charge Compression Ignition, which has enabled the engine to achieve the world's best in-use thermal efficiency and powerful torque that faithfully follows the accelerator. In addition, a cooperative control technology was developed to effectively combine a new 48V mild hybrid system and an automatic transmission with start clutch. This unique control technology not only maximizes the advantage of the highly efficient strong engine but also enhances unrestricted driving feel with immediate response to the accelerator and allows for good fuel economy comparable to a strong hybrid of a competitor. Fig. 1 shows the exterior appearance of the engine, the motor and the transmission. Table 1 shows the main specifications. The motor capable of disconnecting the engine is placed inside the 8-speed transmission without torque converter. During deceleration, the engine is disconnected to maximize energy recuperation, and when the motor is in operation, torque production is assigned to the engine and the motor at the optimum ratio from the efficiency point of view to manage energy. As shown in Fig. 2, the shifting patterns of the transmission were set in the low-rpm region to make maximum use of the high-efficiency region of the engine. At extremely low load, Sequential Valve Timing and stop-position control help to lower the friction generated at restart and minimize the motor assist torque required for restart so that the engine turn-off region can be maximized. Use of the cooperative control led to a 12.6 % improvement in fuel economy. Regarding drivability, new drive force control was devised on the basis of the High-Precision DE Boost Control, with which highly responsive motor torque is allocated effectively, and thus drive force more direct and faithful to the accelerator has been achieved.



Fig.1 External View of Engine and Transmission

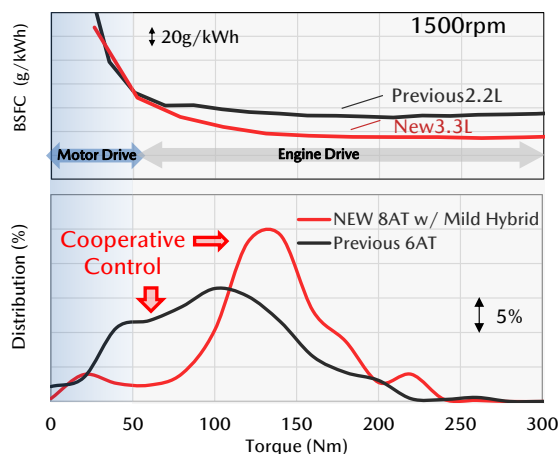


Fig.2 Shift of load distribution by Cooperative Control on Engine. Motor. 8-speed transmission

Table1 System Specifications

Engine	Engine	3.3L Diesel
	Engine Type	In-Line 6 w/ Mild Hybrid
	Displacement	3283 cm <sup>3</sup>
	EGR System	HP-EGR & LP-EGR
	Max Torque / rpm	550 Nm / 1500 ~ 2400 rpm
	Max. Power / rpm	187 kW / 3750 rpm
	Valve System	Intake S-VT
		IVO : -19 ~ 82 deg.ATDC
		IVC : 9 ~ 110 deg.ATDC
		EVO : 40 deg.BTDC EVC : 8 deg.ATDC
Motor	Max Torque / rpm	12.4 kW / 900 rpm
	Max. Power / rpm	153 Nm / 200 rpm
Lithium-ion Battery	Voltage	44.4 V
	Energy Density	0.33 kWh
Fuel Consumption	Large SUV-AWD w/ Mild Hybrid	21.1 km/L