

TRANSPORTATION AND SAFETY IN JAPAN

MULTI-PURPOSE ELECTRIC VEHICLE "KAZ"

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KAZ is a high performance and highly functional vehicle compared with a conventional ICE (Internal Combustion Engine) MPV (Multi-Purpose Vehicle) thanks to the development of new component technologies and system technologies.

KAZ was designed from the ground up and has, therefore, not been converted from an ICE MPV, making the design of the body very flexible. Two views of KAZ are shown in Figure 1 and 2. The specifications of KAZ are shown in Table 1.

KAZ uses three innovative component technologies. The Lithium-ion battery was the most important in order to supply the high energy and high power to KAZ. The Intelligent Power Module (IPM) was useful to make inverters with low energy loss and of a compact size. The motors were developed with Nd-Fe Rare Earth magnets and are highly efficient, with high torque and high-speed but a compact size.



Fig. 1 Side view of KAZ



Fig. 2 Front view of KAZ

KAZ is composed of three newly developed technologies.

1. In-Wheel drives assemble a motor, a reduction gear system, a mechanical brake and a wheel bearing inside a driving wheel. It decreases the transmission loss between the motor and a wheel, reduces the total weight of the vehicle and increases the useful space in the cabin. KAZ uses eight In-Wheel drives with 55kW (73PS) maximum power in each wheel. It means the total output power of KAZ is 440kW (590PS).
2. The components built-in frame integrate all batteries and electrical components inside the strong floor structure. It makes the vehicle lighter in weight, leaves more space to be set aside for the passenger compartment and gives a lower center of gravity. As the height of the integrated chassis is 15cm, the lower height of KAZ is almost the same as a conventional sedan and much lower than a conventional MPV, thus making access much easier.
3. The tandem suspension system

Table 1 Specifications

VEHICLE			GEAR RATIO	4.588
LENGTH	6,700mm		NUMBER OF MOTORS	8
WIDTH	1,950mm			
HEIGHT	1,675mm		INVERTER	
WEIGHT	2,980kg		TYPE	PWM
PASSENGERS	8		OUTPUT VOLTAGE	0-140V
			OUTPUT CURRENT	0-250A
BATTERY			TYRES	188/55-R16
TYPE	Li-ion			
VOLTAGE	3.75V		SUSPENSION	
CAPACITY	88Ah		TYPE	DOUBLE WISHBONE
WEIGHT	3.5kg		SPRING&DAMPER	HYDRO PNEUMATIC
NUMBER OF BATTERIES	84 × 2			
MOTOR			PERFORMANCE	
TYPE	6 PHASE SYNCHRONOUS		MAXIMUM SPEED	311km/h
MAGNET	Nd-Fe		0-400 ACCELERATION TIME	15.4 sec.
MAXIMUM TORQUE	100Nm (without Gear Ratio)		RANGE PER CHARGE	300km (at 100km/h constant speed)
MAXIMUM VELOCITY	12,000rpm			
MAXIMUM POWER	55kW			

is based on pairs of wheels with a hydraulic control. It decreases the wheelhouse to the minimum possible and makes driving very comfortable and very stable.

The conceptual drawing of these technologies is shown in Figure 3.

To make electric vehicles socially acceptable, performance and function must be superior to those of existing cars. Until now, the battery (energy storage) limited the range and autonomy of an electric vehicle. This, together with a lack of acceleration and poor top speeds, are the main reasons why such vehicles have not become popular. The size of the batteries meant that vital space had to be given up by the passenger compartment, making electric vehicles far less versatile in use. KAZ aims to free electric vehicles of their limits based on the following three basic concepts:

- a. Ground-up design;
- b. Collection of best technology;

- c. Adoption of technologies peculiar to electric vehicle.

Thanks to the ground-up design, new component technologies and newly developed system technology, KAZ has a very high performance. The maximum speed is 311km/h, and 0–400m acceleration time is 15.4 sec. These data were measured at the Nardo proving ground, Italy on April 29, 2001. The photograph at the maximum speed of KAZ is shown in Figure 4. Range per charge will be 300km using the Lithium-ion battery. The range will increase to 600km with a range extender whose output power will be 10kW.

KAZ is a Zero-Emission electric vehicle with highly innovative features, which really takes care of environmental issues, and addresses energy problems with its highly efficient power source.

KAZ means peace and it is the first prototype to come out of this important research project into high-

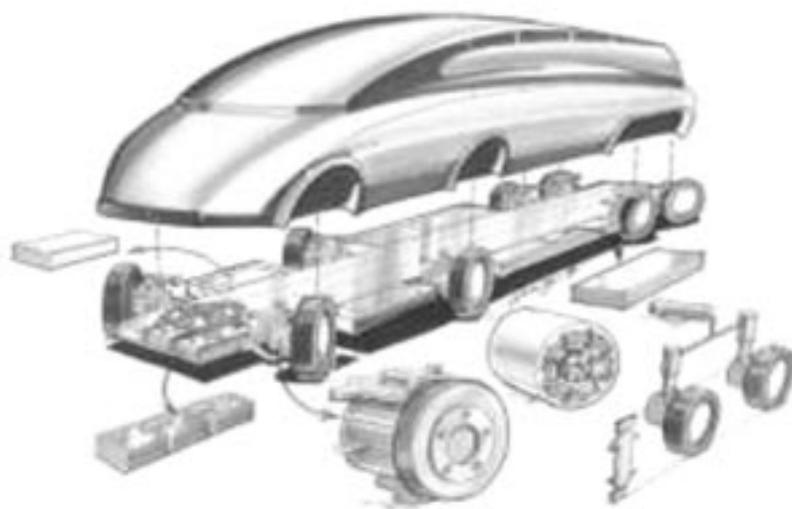


Fig. 3 Conceptual drawing of the structure of KAZ



Fig. 4 Photograph of KAZ at 311km/h speed record

ly functional electric vehicles for the 21st century. KAZ is very stable and comfortable. No tail squat in acceleration and no dive in braking because of a low center of gravity and eight-wheel drive. The acceleration feeling is perfect because the torque of the motor is constant from zero to higher speeds.

KAZ handles very well. Vibration on a rough road is reduced because of the function of the tandem suspension system. Cornering is stable because of a low center of gravity, eight-wheel drive and tandem suspension system.

KAZ, of course, is environmentally friendly with no pollution and low noise when it is running. The energy efficiency is around 1.7 times that of a conventional car.

KAZ has an interesting appearance, which is a modern interpretation of an MPV designed by the team at I.D.E.A Institute, where this first running prototype was also developed and built.

KAZ technology can be applied to all kinds of vehicles, for example, a completely low and flat floor minibus, a low floor and large space van or a high performance passenger car.