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Tokyo Motor Show 2009

Energy Management

— Technology for higher environmental performance of vehicles —

One of the major challenges facing the auto industry today is how to increase fuel efficiency while reducing CO2 emissions. Despite the many advances in technology, only about 20 percent of fuel energy is actually used for driving the vehicle and some is used for other functions like powering the alternator or air conditioning system, while the remaining fuel energy is simply wasted. To help resolve these issues, DENSO is committed to “Energy Management,” an approach to a more efficient use of fuel energy, along with further development of fuel-saving technologies like gasoline direct injection, diesel common rail systems, hybrid system products, and start and stop system components.

DENSO’s Energy Management Approach is Based on the following Principles:

1. Reducing the burden on an engine

DENSO is working to improve the efficiency of alternators so they produce more electricity. The company also strives to reduce the amount of energy consumed by air conditioning systems and other devices. In addition, DENSO is developing a system to control the air conditioning system and alternator in response to the continuously changing engine load, which will use the energy generated by the engine more efficiently.

Looking forward, DENSO is conducting research on a “car-navigation cooperative control system,” a system that uses road information from the car navigation system to precisely control the alternator in accordance with changes in driving conditions.

2. Recovering lost energy through regeneration

There are mainly two types of energy wasted in vehicles: the thermal energy emitted from the engine and other devices, and the kinetic energy dissipated while braking.

To use the wasted thermal energy, DENSO is developing a new system that uses exhaust heat from the engine to improve heating performance during the winter. This also will quickly warm the engine and transmission to the optimum temperature for driving, which helps to improve fuel economy. To better utilize wasted kinetic energy, DENSO is improving the performance of products and systems that convert deceleration energy into electricity.

By integrating a wide range of technologies used in powertrain, thermal, electric, electronic and information and safety systems, DENSO is developing environmentally friendly technologies. These efforts help contribute to the improvement of a vehicle's environmental impact without influencing the vehicle's safety, comfort, or convenience.

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Hybrid System Technology

— Developing smaller, lighter, and higher output products —

Not only do hybrid vehicles consume less fuel than conventionally powered vehicles, they emit lower CO2 emissions and offer improved performance. With a heightened sense of environmental consciousness, due to global warming and the depletion of petroleum resources, hybrid vehicles are expected to increase worldwide.

Since the introduction of the first Toyota Prius in 1997, DENSO has offered several hybrid vehicle components, including power control units (PCU), battery monitoring units, hybrid electronic control units (ECU), DC-DC converters, and electric compressors. Because hybrid vehicles involve more components than a conventionally powered vehicle it is critical to reduce the size, weight, and cost of each part.

DENSO offers a variety of technologies related to engine, motor and battery control, high-voltage and high-current semiconductor technologies, and cooling technologies to control the temperature in semiconductor devices operating at a high voltage. By combining these technologies, DENSO provides smaller hybrid vehicle products with a higher performance.

As hybrid vehicles increase capability and performance, PCUs are required to be made smaller, lighter, and with a higher output. DENSO has developed a PCU that is equipped with a unique cooling structure that significantly improves cooling performance for power semiconductor devices that constitute the PCU. Compared to DENSO's conventional product, the new PCU has an improved power density of 60 percent, and is 30 percent smaller and 20 percent lighter. To achieve this, the company applied its know-how of cooling and electronics technologies from its in-house development and production of radiators and semiconductor devices. This PCU is installed in the Lexus LS600h and Lexus RX450h.

DENSO will continue to utilize its wide range of expertise to develop innovative technologies for high-performance hybrid vehicle products that are smaller and lighter, while also contributing to the widespread use of hybrid vehicles.

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Diesel Development

— Contributing to cleaner emissions and improved fuel efficiency —

Diesel-powered vehicles offer excellent fuel economy and power, and emit approximately 20 percent less carbon dioxide (CO₂) emissions compared to gasoline-powered vehicles. DENSO continues to develop diesel engine management systems and components for injection control and after-treatment, helping contribute to the development of clean diesel vehicles.

The higher fuel injection pressure of common rail systems allows for a finer fuel atomization spray, which helps reduce the particulate matter (PM) in emissions. Also, the precisely controlled, multiple injections during a combustion cycle help reduce harmful emissions, such as nitrogen oxide (NO_x).

In 1995, DENSO launched the world's first innovative diesel common rail system and in 2002 introduced the 180 MPa (1800 bar) system with five multiple injections, achieving the highest injection pressure in the world at that time. In 2009, DENSO launched a 200 MPa (2000 bar) system with nine multiple injections.

DENSO common rail systems are produced in Japan, Hungary, Thailand, and China and are installed on diesel vehicles in countries and regions worldwide.

For diesel after-treatment, DENSO has been producing and supplying high performance and cost-effective diesel particulate filters (DPFs) made of cordierite since 2003. Compared to other DPFs, DENSO's cordierite DPFs are light-weight and have low pressure loss and high filtration efficiency, leading to better engine performance.

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Permanently Engaged Starter for Start and Stop Systems

— **Achieving quicker and quieter engine restart and less engine stop vibration** —

Start and stop systems automatically stop the engine while the vehicle is idling at a stop light or in other traffic situations to help reduce fuel consumption and CO2 emissions. Demand for this system is expected to grow as worldwide CO2 emission regulations become more stringent and as consumers want more environment-friendly vehicles.

DENSO has developed the permanently engaged starter, a key component for start and stop systems, which achieves a quicker, smoother and quieter engine-restart. Created jointly with Toyota Motor Corp., the starter is used in Toyota models, such as the Auris and Yaris models sold in Europe since January 2009.

Conventional start and stop system starters disengage gears, which can result in up to a 1.5 second engine-restart delay. More specifically, when starting a conventional starter, the pinion gear is thrust forward to engage the ring gear (the engine flywheel gear), and when the ignition key is returned to the “on” position, the two gears disengage to bring the pinion gear back to the original position. With this conventional structure the pinion gear does not mesh with the ring gear while the ring gear is coasting - even after the vehicle is stopped and the fuel supply ceases - which results in the delayed restart immediately after the vehicle has stopped. DENSO’s permanently engaged starter solves this issue because it constantly engages the pinion and ring gear, allowing the engine to restart more quickly and smoothly.

Compared to conventional starters, the new starter’s structure also prevents gear-tooth striking noise. For better driver comfort, DENSO also uses a rubber shock absorber and a clutch to isolate engine oscillations* that help reduce engine-restart noise and engine-stop vibrations.

DENSO, which has been making starters since its foundation 60 years ago, has been commercially producing start and stop system starters since 2003. Based on its technologies accumulated over many years, DENSO will continue to develop products to help vehicles increase fuel efficiency and reduce CO2 emissions.

*Engine oscillation refers to when the engine repeats forward rotation and reverse rotation before it is stopped completely, causing the vehicle’s seats to vibrate.

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Sensing System Technology

— Combing multiple sensors for improved safety —

DENSO is committed to helping improve safety on roadways worldwide and has focused on developing sensing technologies for safety devices that help prevent accidents and mitigate the damage in a potential accident. Now, the company is working to realize a more comprehensive sensing system by combining multiple sensors into a single-packaged system.

Currently, most safety systems use one sensor technology per device. For example, the Lane Keeping Assist employs one sensor -a vision sensor- that will sense when the vehicle is about to inadvertently change lanes. To create a more comprehensive safety system, DENSO is developing the Sensing System technology, which uses multiple sensors to detect the vehicle's surrounding environment and communicate important information to the vehicle's various support systems.

DENSO's Sensing System technology can be applied to many Driver Support devices because the use of various sensors allows for greater flexibility among the systems. For instance, by combining a millimeter-wave radar sensor and a vision sensor, the sensing system can recognize the shape, size and type of an object. The millimeter-wave radar sensor detects the position and relative velocity of the object, while the vision sensor detects the type and different attributes of the object. As a result, it is possible to accurately identify the positional relationship between the object and the vehicle, as well as the object's relative movement, leading to a safety system that is better tailored for an individual situation.

Not only is DENSO contributing to a safer driving environment with the further development of advanced safety technologies, but DENSO also is working to integrate information systems, such as driving conditions, external communication and map information, to add to a driver's comfort and convenience.

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Passenger Vehicle Air Conditioning System Using an Ejector

— **Contributes to significant reduction of compressor's power consumption** —

DENSO Corporation has developed the world's first vehicle air conditioning system that uses ejector technology. The ejector, which is a small refrigerant injector, helps reduce the compressor's power consumption by up to about 25 percent, compared to conventional vehicle air conditioning systems, and thus contributes to fuel savings.

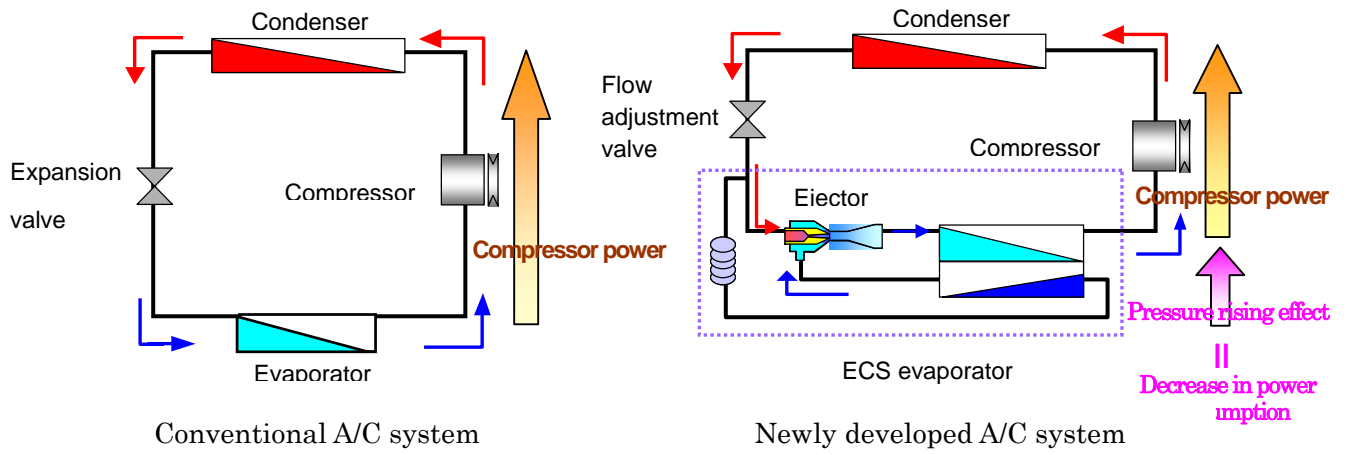
Much of the energy consumed by a vehicle's air conditioning system is used by the compressor to compress the refrigerant. In conventional air conditioning systems, an expansion valve is used to reduce the pressure of the refrigerant before passing it through the evaporator to cool the air.

This system uses an ejector instead of an expansion valve. The ejector recovers expansion energy, which was previously lost in the expansion valve, and converts it into pressure energy. This, reduces the compressor's workload and helps reduce the air conditioner's overall power consumption.

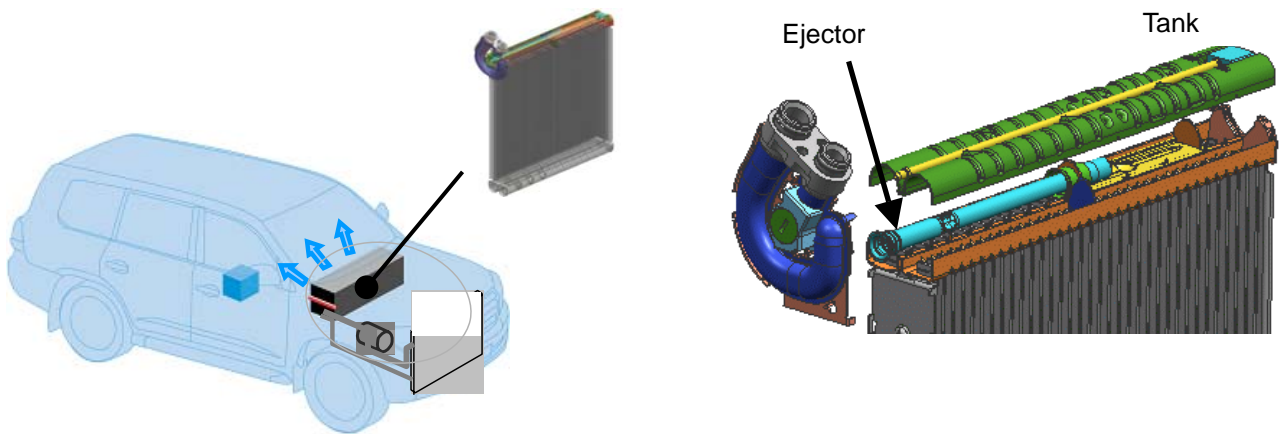
DENSO previously applied ejector technology to truck refrigeration units and household CO₂ heat-pump water heaters. The conventional ejector was not small enough to be installed in vehicle air conditioning systems. DENSO overcame this challenge with its new air conditioning system by integrating the ejector into the evaporator tank, where refrigerant flows. This design eliminates the need for the ejector to have a thicker structure to withstand external pressure and also eliminates pipe connection parts needed to connect the ejector with the evaporator, which helps reduce the size of the ejector. The ejector cycle system evaporator (ECS evaporator), which is equivalent to the size of a conventional evaporator, can also be applied to conventional air conditioning systems.

The system is installed on the Prius, introduced by Toyota in May 2009.

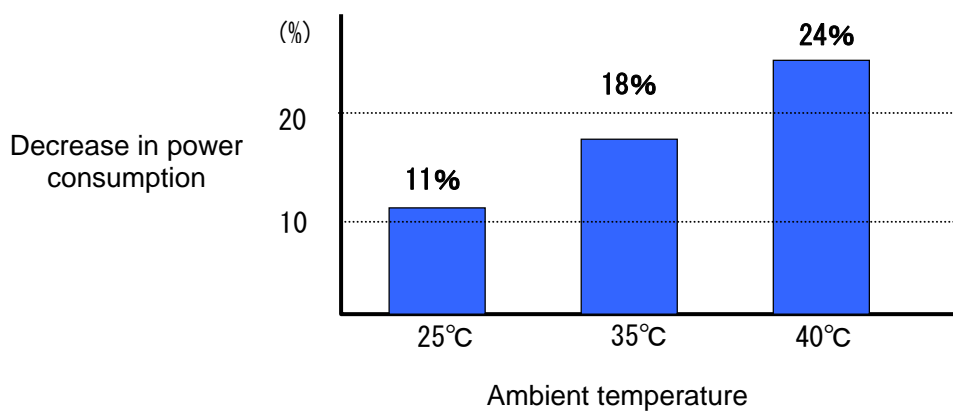
Comparison of refrigeration cycle



Installation image of ECS evaporator



Reduction effect in power consumption of compressor



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Small Air Conditioning Unit for Compact Vehicles

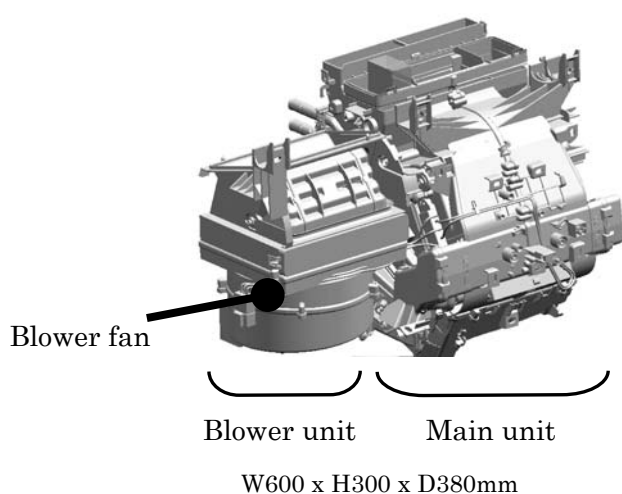
— 20 percent smaller in size and contributes to more legroom for front passenger —

DENSO Corporation has developed a new air conditioning unit, which is approximately 20 percent smaller in volume than the conventional product.

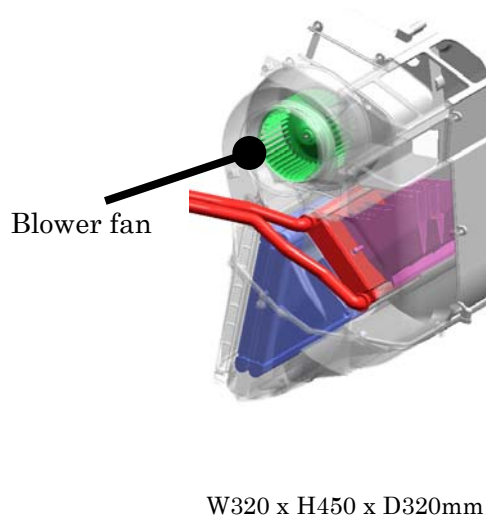
With improvements including new resin molding technologies, DENSO reduced the size of the blower fan. This allows the blower unit containing the blower fan to be reduced by almost half the size of the conventional component, contributing to the size reduction of the air conditioning unit.

This air conditioning unit also can be mounted in the center of the instrument panel to create more legroom for the front passenger. DENSO achieved this by integrating the blower unit - which generally is separated from the main unit and located above the front passenger's leg space - into the uppermost side of the main unit.

The new system is installed on Toyota's compact car, the "iQ," launched in Japan in November 2008.



Conventional air conditioning unit



Newly developed air conditioning unit

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Remote Touch Controller

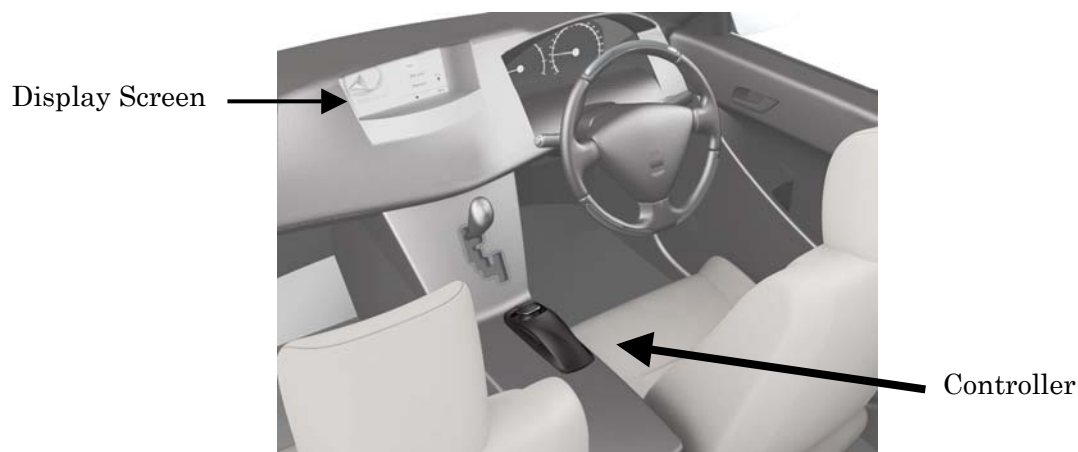
— **A user-friendly human machine interface that helps to ease driver workload** —

DENSO Corporation has developed a new user-friendly, human machine interface (HMI) called the Remote Touch Controller, which features a two-dimensional cursor on the display screen. The device, similar to a joystick and located in the vehicle's center console, allows the driver to remotely control cabin equipment, such as the car navigation, audio and air conditioning systems. DENSO's Remote Touch Controller is the world's first such controller for vehicles with a two-dimensional cursor on the display screen.

The new controller has a computer mouse-like pointing device that moves the cursor on the display screen to select buttons, icons, and other interface elements. This more user-friendly HMI allows the driver to remotely operate cabin equipment more easily and accurately, helping to ease driver workload. DENSO's Remote Touch Controller has two electric motors that simulate a "clicking" feeling as if the cursor is drawn toward the target button when moving the cursor closer to the graphical symbol on the display.

The new controller is installed on the Lexus RX 450h/350 and HS 250, which Toyota Motor Corporation introduced in 2009.

Installation image of Remote Touch Controller



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Exhibited Products List

INTEGRATED EFFICIENCY DISPLAY FOCUSING ON FUEL SAVING TECHNOLOGIES

Environment Zone

- ◆ Hybrid Vehicle Components
 - Power Control Unit
 - Battery Monitoring Unit
 - Battery Current Sensor
- ◆ Gasoline EMS
 - High Pressure Injector
 - High Pressure Pump
 - O2 Sensor
 - Air-fuel Ratio Sensor
 - ECU
- ◆ Diesel EMS
 - Injector
 - Supply Pump
 - Rail
 - Diesel Particulate Filter
 - Electronic Injector Driver Unit
- ◆ Permanently Engaged Starter
- ◆ SC Alternator
- ◆ Heat Storage System for Engine Warm-up
- ◆ Electric Power Steering System
 - Electric Power Steering ECU
 - Electric Power Steering Motor
- ◆ SiC Power Device

Safety Zone

- ◆ On-board Unit for Cooperative System
- ◆ Sensing System
 - Millimeter-wave Radar Sensor
 - Vision Sensor
 - Driving Support System ECU
- ◆ Full TFT-LCD Instrument Cluster
- ◆ Adaptive Front Lighting Systems (AFS)
 - AFS ECU
 - Stepping Motor for Headlight Swivel
 - Stepping Motor for Headlight Leveling
 - High Intensity Discharge Lamp
 - Ballast
- ◆ Airbag Sensors & ECU
 - Airbag Electronic Satellite Sensor
 - Airbag ECU
 - Passenger Presence Sensor

- more -

Comfort Zone

- ◆ Ejector Cycle System (ECS)
Evaporator
- ◆ Small Air Conditioning Unit for
Compact Vehicles

- ◆ Climate Control Panel
- ◆ Climate Control ECU
- ◆ Compressor

Convenience Zone

- ◆ Car Navigation System
- ◆ Remote Touch Controller
- ◆ ETC System On-board Equipment
- ◆ Data Communication Module

- ◆ Smart Entry and Smart Engine Start
Systems
- Smart Key (FOB Type)
- Smart Key (Card Type)
- Tuner

INDIVIDUAL EXHIBIT

Environment Zone

- ◆ Diesel Engine Management System
 - Supply Pump
 - Rail
 - Piezo Injector (200MPa)
 - Boost Pressure Sensor
 - Crank Position Sensor
 - Electronic Throttle Body
 - EGR Valve
 - Air Flow Meter
 - Glow Plug
 - Air-fuel Ration Sensor
 - Exhaust Gas Pressure Sensor
 - Exhaust Gas Temperature Sensor
 - Diesel Particulate Filter (DPF)
 - Electronic Control Unit (ECU)
 - Electronic Injector Driver Unit (EDU)
 - Intercooler
 - Exhaust Port Fuel Injector
- ◆ Permanently Engaged Starter
- ◆ Radiator Tank Made from
Plant-derived Resin
- ◆ SiC Power Devices
(Tokyo Motor Show Only)
- ◆ Absorbing CO₂ into algae to create
biofuel (Tokyo Motor Show Only)

- ◆ Hybrid Vehicle Components and
Gasoline EMS
- High Pressure Injector
- High Pressure Pump
- Iridium Spark Plug
- Fuel Pressure Sensor
- Fuel Pump Module
- Stick Coil
- Air Flow Meter
- Catalytic Substrate
- Electronic Throttle Body
- O₂ Sensor
- Air-fuel Ratio Sensor
- Intake VVT (Variable Valve Timing)
- Exhaust VVT (Variable Valve Timing)
- Crank Position Sensor
- Manifold Absolute Pressure Sensor
- DC-DC Converter
- Battery Monitoring Unit
- Electronic Injector Driver Unit (EDU)
- Battery Current Sensor
- System Main Relay
- Electronic Control Unit (ECU) for
Hybrid Vehicle
- Power Control Unit

Safety Zone

- ◆ Sensing System
 - Millimeter-wave Radar Sensor
 - Vision Sensor
 - Electronic Control Unit (ECU) for
Driving Assistance System

- ◆ Full TFT Color LCD Instrument
Cluster Featuring Night View System
with Pedestrian Detection Function
- ◆ Image Recognition Technology

- more -

Comfort Zone

- ◆ Passenger Vehicle Air Conditioning System Using an Ejector
- Ejector Cycle System (ECS) Evaporator

- ◆ Small Air Conditioning Unit for Compact Vehicles
- New Air Conditioning Unit for Compact Vehicles
- Conventional Air Conditioning Unit for Compact Vehicles

Convenience Zone

- ◆ Remote Touch Controller

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DENSO Global Facts

CORPORATE HEADQUARTERS

DENSO CORPORATION, Kariya, Aichi, Japan

TOP MANAGEMENT

Chairman: Koichi Fukaya

President and CEO: Nobuaki Katoh

ESTABLISHED

December 16, 1949

GLOBAL OPERATIONS (as of March 31, 2009)

Subsidiaries/Affiliates (in Japan): 81

Subsidiaries/Affiliates (outside Japan): 138

GLOBAL EMPLOYEES (TOTAL WORLDWIDE, as of March 31, 2009)

119,919

GLOBAL FINANCIAL RESULTS

Consolidated Net Sales: 3,142.7.7 billion Yen (US\$32.0 billion or 24.2 billion Euro)

Fiscal Year: Ended March 31, 2009

Note: US\$ and Euro amounts have been translated, for convenience only, at the rate of
98.23 Yen = US\$1 and 129.84 Yen = 1 Euro, the approximate exchange rate prevailing on March 31,
2009. Billion is used in the American sense of one thousand million.

REGIONAL HEADQUARTERS

Europe: DENSO EUROPE B.V., Weesp, the Netherlands

The Americas: DENSO International America, Inc., Southfield, Michigan

Asia/Oceania: DENSO International Asia Pte. Ltd., The Aires, Singapore

DENSO International Asia Co., Ltd., Samutprakarn, Thailand

China: DENSO (China) Investment Co., Ltd., Beijing, China

COUNTRIES and REGIONS: 33

Japan, United States, Canada, Mexico, Brazil, Argentina, Netherlands, United Kingdom, Germany, Spain, Italy, France, Hungary, Sweden, Poland, Belgium, Portugal, Czech Republic, Turkey, Russia, Australia, Singapore, Thailand, Indonesia, Republic of Korea, Malaysia, India, Taiwan, China, Philippines, Saudi Arabia, Vietnam and South Africa.

OPERATING SUMMARY BY INDUSTRY SEGMENT

<Automotive sub-total: 96.8 percent of global net sales>

Thermal Systems:	32.0 percent
Powertrain Control Systems:	23.6 percent
Information and Safety Systems:	15.0 percent
Electric Systems:	9.3 percent
Electronic Systems:	8.7 percent
Small Motors:	7.0 percent
Other Automotive:	1.2 percent

<New businesses sub-total: 3.2 percent>

Industrial Systems and Consumer Products:	1.7 percent
Others:	1.5 percent

WEB SITES

www.globaldenso.com

www.densomedia-na.com/

www.denso-europe.com

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Nobuaki Katoh

President and CEO, DENSO Corporation

Nobuaki Katoh began serving as the president and CEO of DENSO Corporation, headquartered in Kariya, Aichi, Japan in June 2008.

Katoh joined DENSO Corporation (formerly Nippondenso Co., Ltd.) in 1971 after graduating from Keio University in Tokyo with a degree in Business and Commerce.

In 1996, Katoh was named general manager of the Air-Conditioning Planning Department, where his main responsibilities included developing business strategies to increase DENSO's share of the air conditioning market. Katoh's strategies worked: DENSO's share of the air conditioning market increased, and DENSO has maintained the global number one market share for air conditioners for more than 10 years.

In 1999, Katoh was made general manager of the General Planning Department, and one year later, was promoted to director. In this position, he has used his planning skills to help further globalize DENSO Corporation.

In June 2004, he was named one of DENSO's managing officers, and became president of DENSO's European headquarters in June 2005. He was promoted to senior managing director and returned to Japan in June 2007.

DENSO, a leading global supplier of advanced automotive technology, systems and components, employs approximately 120,000 people in 33 countries and regions, including Japan. Consolidated global sales for the fiscal year ended March 31, 2009 totaled US\$32.0 billion.

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DENSO Photos



Nobuaki Katoh
President and CEO,
DENSO Corporation



Power Control Unit for
Hybrid System



2,000 bar Diesel Common
Rail System



Permanently Engaged
Starter for Start and Stop
System



Ejector Cycle System
Evaporator



A/C System for Compact
Vehicles



Remote Touch Controller

Photos can be found and downloaded at: <http://www.globaldenso.com/en/events/tokiomotorshow/>

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