Media Contact:
Yee Chow
(617) 869-6355
ychow@acropulsion.com

AC Propulsion Partners with BMW to Build 500 Electric Vehicles

Mini E debuts at the 2008 Los Angeles Auto Show and demonstrates best-in-class technology to maximize performance of electric vehicles at a decreased cost

San Dimas, CA – Nov. 19, 2008 – AC Propulsion, a global leader in electric vehicle technology and services, today announced that it partnered with BMW Group to supply the electric propulsion and battery technology for the MINI E electric vehicle, which was introduced today at the LA Auto Show. AC Propulsion has delivered over 500 drive systems to the BMW Group factory in Munich for MINI E production.

“Working with BMW Group on the MINI E project has been a great experience,” said AC Propulsion CEO Tom Gage, “The schedule was tight and required a lot of discipline and coordination. We’ve had cars with our drive systems on the road since 1992, and some have well over 100,000 miles on them, so we’ve seen our systems handle the rigors of daily use. This is a big step for electric vehicles.”

The MINI E uses a specially-developed version of AC Propulsion’s proprietary tzero™ technology to provide high performance, high efficiency, and fast charging. The motor is able to produce peak power of 150 kW, resulting in 204 horsepower. Even with such a high power rating, the AC Propulsion drive system still operates with high efficiency with normal driving. Powerful regenerative braking adds to the efficiency and driving appeal: when the MINI E decelerates, the kinetic energy of motion is converted back to electrical energy in the battery.

AC Propulsion also supplied the battery for the MINI E, which is composed of 48 Li Ion modules. AC Propulsion assembled each module from 106 small Li Ion cells using proprietary assembly techniques and battery management technology. “Our Li Ion modules are developed specifically for electric vehicles, not hybrids,” Gage stated, “so they are lighter and less costly than hybrid batteries for the same amount of energy. Combine the high energy of our batteries and the high efficiency of our drive system, and we deliver excellent range capability at a competetive price.”

AC Propulsion’s patented V2G-capable bi-directional battery charger is an integral part of the AC Propulsion drive system used in the MINI E. Wherever the car goes, the

charger goes. When the wallbox outlet is connected to the charge port on the MINI E, charging proceeds automatically. The AC Propulsion charger is flexible and can use 120V, 208V, or 240V outlets.

SYSTEM DESCRIPTION

The AC Propulsion drive system includes a power electronics unit and AC-induction traction motor featuring proprietary and patented tzero™ technology to provide high performance, high efficiency, and rapid, convenient charging capabilities for electric vehicle applications. The system delivers up to 150 kW (200 hp) motor output, yet maximizes vehicle operating range with high efficiency over a broad operating range and comprehensive energy recovery through regenerative braking. The tzero™ technology includes patented control and construction techniques that allow the power electronics and motor windings to be re-configured as a high-rate Reductive™ battery charger. By using existing componentry, the Reductive™ Charger reduces vehicle cost and weight. By allowing safe charging from existing 110V to 240V outlets at rates as high as 20 kW, the Reductive™ Charger reduces infrastructure installation requirements and costs, and its innovative bi-directional power capability allows self contained vehicle battery diagnostics and standby power generation.

SYSTEM FEATURES

Advanced Drive Control Circuitry

- "Glass smooth" torque under all load and speed conditions
- Natural and transparent driving feel
- Driver adjustable regeneration
- Traction control, speed control available
- Integral power distribution and fusing for accessory drive, cabin heater, and hybrid or fuel cell APU

Integrated Reductive™ Charger

- Charge from any source, 100-250 VAC
- Charge rate controllable from 200W up to 20kW (with 240 V line)
- Unity power factor, sine wave current draw
- GFI outlet compatible
- Automatic mode switching (recharge mode activated when charge power is connected)
- Controlled battery discharge into power line for battery diagnostics and V2G
- UPS mode for backup power and energy transfer to other electric vehicles.

Designed-in Safety

- No exposed high voltage surfaces
- All control wiring is grounded, 12 V or less
- Protection against over-current, over-voltage and over-temperature conditions.
- Battery floats with respect to vehicle chassis
- Double insulated motor
- Zero motor back-EMF when excitation removed
- Interlocks prevent accidental operation

OPERATING PERFORMANCE

- Voltage 350 V nominal
- 240 V min, 450 V max
- Current 580 Adc max (drive)
- 200 Adc max (regeneration)
- Torque 225 Nm max, 0-5,000 rpm (drive)
- 115 Nm max (regeneration)
- Power 150 kW max 6,000-12,000 rpm
- 50 kW continuous

EFFICIENCY

- Drive: 91% peak
- 86% road load (30 kW, 8500 rpm)
- Charge: >90% (240 V line, 10 kW)

POWER ELECTRONICS UNIT

- Pulse-width-modulated, voltage fed, IGBT inverter with current mode, sine-modulated controls; battery charging circuitry; auxiliary 13.5V power supply; and interfaces for control pedals and dash instruments. Environmentally rugged forced air-cooled design.
- Dimensions*: 186 x 313 x 760 mm
- Total weight: 30 kg (incl blower)
- Cooling: Forced-air with pwm control
- Power connectors: Aircraft-style circular
- Control connectors: automotive
- Control inputs: Ground-referenced signals for key switch, accelerator pedal, regenerative sensitivity, forward, neutral, and reverse; and RS-232 for recharge/discharge control
- Instrumentation outputs: RS-232 for battery voltage, inverter, hybrid and drive current, inverter temp, motor temp, motor rpm, motor direction, line voltage, line current, battery isolation, and 12V bus voltage
- Power supply current**: 100 A @ 13.5 V

MOTOR

- Four-pole induction, high frequency design with inverter-controlled magnetic flux.
- Dimensions*: 245mm dia x 350 mm long
- Total weight: 50 kg (incl blower)
- Maximum rpm: 13,000
- Insulation: Class H, double-insulated
- Cooling: Forced-air with pwm control
- Sensors: Winding temp, tachometer

* dimensions exclude blower and connectors
** up to 30 A allocated for cooling blowers

About AC Propulsion

AC Propulsion is the global leader in the development, design and manufacture of electric vehicle technology. AC Propulsion's proprietary tzero™ technology is a complete solution for electric vehicles, and can be customized for every class of electric vehicle, from a sports car to an SUV to an 8-ton city bus.

Products within in ztero™ product suite include:

- Drive System: includes an integrated, bi-directional battery charger, Power Electronics Unit (PEU) and Motor
- Battery Management System: manages and extends battery range and operating life
- Vehicle Management System: controls operation and provides an interface to other components of the vehicle

Engineering Services include:

- Design services: AC Propulsion works with our customers to customize tzero™ technology to suit their needs
- Licensing tzero™ technology: tzero™ technology is available for a non-exclusive license to manufacturers who want to develop and manufacture their own propulsion systems
- Intellectual Property: Our proprietary technology improves vehicle efficiency and range, reduce cost and enhance customer satisfaction with the final product.

AC Propulsion's technology allows for 200 kW or 268 horsepower, up to a 300 mile range at 60 mph and the ability to replenish 90 miles per hour charging in any standard outlet. AC Propulsion is also a leader in the development of Vehicle to Grid (V2G)-capable vehicles, as well as the research and development of V2G technology.

For further information, please visit www.acpropulsion.com

Yee Chow
AC Propulsion
(617) 869-6355
ychow@acpropulsion.com