

# Electric traction systems

Following an agreement with a Chinese manufacturer of rotating electric systems, TM4 is now deploying its heavy-duty electric powertrain technologies worldwide

▶▶ Spun off from Hydro-Québec in 1998, TM4 pioneered the electric propulsion system technology developed by Hydro-Québec's renowned research center. Today, it provides its customers with distinctive expertise in leveraging its permanent magnet, power electronics and control technology, to enhance the performance of electric and hybrid transport applications.

TM4 has developed its Sumo powertrain line specifically for the medium- and heavy-duty commercial vehicle markets. These motors are high torque/low speed and designed to interface with standard rear differentials without the need for an intermediate gearbox. The first of these systems was launched in May 2012 and, with its 3,400Nm of torque, targets heavy-duty vehicles.

In North America, one of TM4's key customers for this product is bus manufacturer Nova Bus, a Volvo Bus subsidiary. Both companies are part of a government-funded electric bus development and commercialization consortium. The Sumo systems have also been delivered to multiple

Right: An electric bus equipped with a PEPS-supplied electric powertrain  
Below: The LSM280 high torque motor which is part of the TM4 Sumo powertrain line for medium- and heavy-duty commercial vehicles



companies in Europe, North America and China.

Retaining its direct-drive approach for commercial vehicles, TM4 will also launch in 2013 smaller variants of its Sumo powertrains for medium-duty buses and commercial vehicles. There are many benefits when removing the transmission of an electric vehicle. While improving system reliability and reducing overall maintenance costs, it also increases the powertrain's efficiency considerably, allowing optimal use of the energy stored in the battery pack.

All of TM4's motors are combined with a new generation of high-voltage controllers delivering the industry's highest specific power and current densities. Part of the reason behind this achievement is TM4's Reflex gate driver technology. Combining hardware and software innovations, this innovation anticipates a voltage peak on the

IGBT, and ensures that it never reaches the voltage limit. TM4 uses standard automotive grade IGBTs, but designs and manufactures its own gate drivers. While other companies using the same module limit the current to 450A, TM4 manages to limit the current to 650A (at 450V, 20 kHz, 65°C). TM4's unique new feature is an active mechanism that uses the stray inductance of the IGBT to control the current during the turn-off process, without slowing down the rate of voltage change. It is only active when necessary, and it has virtually no negative effect on efficiency and temperature.

In 2012, to accelerate the worldwide deployment of its products, TM4 entered into an agreement with Prestolite Electric Beijing for the creation of a sino/foreign equity joint venture company named Prestolite E-Propulsion Systems (Beijing) (PEPS). Leveraging TM4's licensed powertrain technologies and Prestolite Electric Beijing's extensive network and outstanding reputation in ASEAN markets, PEPS is developing, manufacturing, selling

and supporting electric traction systems for trucks and buses, as well as commercial, off-road and marine vehicles. This joint venture supplies clients in China, Taiwan, Hong Kong and Macao, as well as Indonesia, the Philippines, Thailand, Singapore and the other ASEAN countries.

For more than a year, PEPS has been testing and evaluating the new powertrain technologies developed by TM4 with many OEM partners and customers. TM4's heavy-duty motors and controllers received the China National Accreditation Service certification in June 2012, a first step toward commercialization of these products by PEPS.

PEPS' production facility, located in Beijing, started production in June 2013 and will initially produce up to 4,000 heavy-duty powertrains annually. ☺



Patented wire coil forming machine used during the stator manufacturing process at TM4's Boucherville facility

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