Major OEM uses HORIBA fuel cell, battery, and ePowertrain test technology to build all-in-one heavy-duty powertrain integration testing facility.

As more stringent emissions regulations drive changes in heavy-duty engine design, the development and testing of electrified vehicle solutions receives growing interest. While internal combustion engines are expected to remain the primary propulsion method for heavy-duty vehicles for the near-to-medium term, most OEMs/manufacturers are developing pure electric vehicles as part of a long-term, zero-emissions strategy. The power produced from fuel cells could be a clean power technology that fits well in a long-term, zero-emission transportation strategy and is totally complimentary to battery electric powertrains. As a result, fuel cells have become an important part of the heavy-duty technology roadmap.

Proton Exchange Membrane (PEM) fuel cells are an ideal choice for vehicles that require a high, continuous power demand—such as short-haul, agricultural, construction, off-highway, and mining applications. For these applications, PEM fuel cells hold several advantages over battery-only forms of vehicle electrification for a few key reasons. First, they provide the high energy density needed to meet the operative demands of large vehicles and offer higher payload than a battery-only solution. They also do not require long recharging (refueling) times, which is very important for vehicles with high utilization rates performing in a just-in-time business environment.

Fuel cell system test station. Fuel cell system enclosed in cabinet.

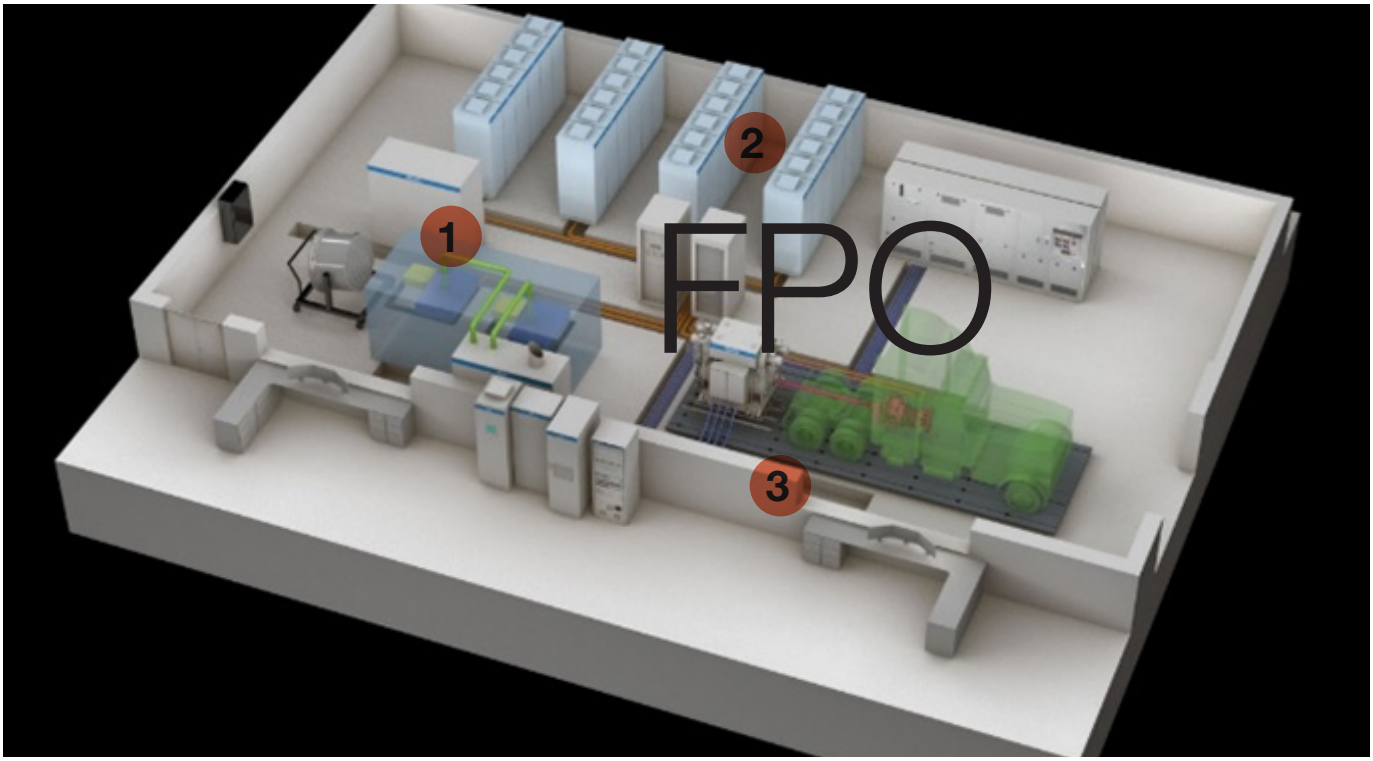
Proven experience and expertise to deliver a complete TIL-based, future-proofed testing environment for heavy-duty vehicles.

Heavy-duty manufacturers and developers that want to develop and/or integrate their own EV components require a future-proof test environment that incorporates a mix of solutions. As the industry evolves, a diverse mix of powertrains will coexist, and capability demand from hybrids and EVs will increase across vehicle configurations and requirements. The ability to perform critical testing functions in parallel, or testing-in-the-loop (TIL), allows greater flexibility and efficacy and contributes to accelerated development cycles with reduced risk.

THREE SPECIALIZED TESTING AREAS

Deliver a comprehensive solution

Performing vehicle development in parallel testing phases shortens the overall process, and allows developers to make adjustments early in the design and integration process. The fuel cell powertrain testing facility shown features three main sub-sections: the powertrain development area where a range of simulation is conducted using the prime mover, the fuel cell system area that powers the prime mover, and the battery emulation area. Battery emulation provides a variety of functions, including supplemental energy for the fuel cell system(s), buffering, and storage of regenerated power from the powertrain under test. Together, these sub-sections provide a complete vehicle testing experience where real-world impacts are assessed within a controlled lab environment, with the safety of purpose-built component test stands. This comprehensive testing solution is automated by HORIBA STARS Powertrain, which integrates all functions of the testing environment under one platform and provides the user real-time results. STARS Enterprise Apps manage data preparation and sharing of results.



Charge and discharge unit with grid feedback and HV battery emulator

1 FUEL CELL SYSTEM

Working with hydrogen fuel and fuel cells requires expertise. HORIBA-FuelCon has decades of experience in providing safe, efficient, and accurate hydrogen storage and delivery to fuel cell systems. Although the automotive fuel cell systems in production today are typically in the 115-120kW range, they are constructed as stacks. This allows engineers to connect multiple individual stacks in order to develop a system that meets the power requirements of the application. Furthermore, R&D breakthroughs in fuel cells are resulting in an increase in power density. We are now able to realize 200kW-250kW stacks with reduced weight and less volume footprint. HORIBA-FuelCon solutions provide fuel cell test stands for R&D and support hydrogen delivery and conditioning systems that meet current and future requirements. As new challenges emerge—such as hydrogen consumption, hydrogen crossover, and fuel cell degradation measurements—HORIBA-FuelCon will continue to provide the solutions necessary to meet them.

2 BATTERY CHARGE/DISCHARGE UNITS

Heavy-duty and high performance battery electric vehicles are moving to higher buss voltages that approach 900 Vdc. At the same time, heavy-duty applications typically have high power demands from the battery pack either to support the fuel cell system during a transient event, or on a total energy basis over the driving cycle. HORIBA's battery charge/discharge units with battery pack emulation software are multi-use, configurable systems that validate a supplier's battery pack, emulate a battery pack for verification of sizing and thermal management, or augment the DC power loading capability for testing multiple fuel cell systems at the same time. A single charge/discharge system can support up to 1.5MW with a maximum voltage of 1200 Vdc. This allows the additional use case of testing power electronic modules used for charging and DC-DC conversion.

3 E-POWERTRAIN DEVELOPMENT AREA

This critical area houses a massive 1.2 MW transmission output DYNAS3 dynamometer shaft-coupled to the test specimen (a heavy-duty, dual e-motor, e-transmission). It is capable of providing 5000 RPMs, with peak torque at 20,000 N-ms. More than just powerful, this dynamometer provides excellent zero speed and very low speed control under transient torque conditions to optimize vehicle launch and power management. It also provides road load simulation under a full spectrum of conditions to enable power and torque optimization of the the vehicle control unit, which also has command authority over areas 1 (fuel cell systems) and 2 (battery pack emulation). This is important to meet drive-cycle demands, and to ensure that the vehicle meets the anticipated needs of the end use application.

From component level, to complete vehicle integration and validation, we support a full range of propulsion systems to help the heavy-duty industry gradually shift from combustion engines, to fully electric powertrain solutions.