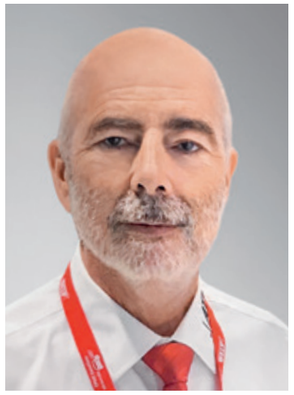
ATEQ READY TO TEST HEV/EV/PEV/FUEL CELL EV VEHICLES

Jacques Mouchet
President, ATEQ

Whether it involves electric cars, trucks, buses or bikes, the ATEQ Group, a multinational measurement solutions provider with more than 45 years of experience, provides the quality processes car manufacturers require to manufacture better, faster and more reliable HEV/EV/PEV/Fuel Cell EV vehicles.

/Using leak testing in the mass manufacturing of electric vehicles is relatively recent since the transportation industry was accustomed to testing internal combustion engines and turbojets. The drive away from fossil fuels and CO_2 emissions has driven the development of new technologies. These new devices present new challenges for production line leak testing. Testing for leaks in one submarine electric motor or battery system per year versus leak testing thousands of vehicle motors per day has very different testing solutions.

E-mobility is not for toys and prototypes anymore. E-vehicles can range from an electric assisted bicycle, a fully electric motorbike or scooter, a fully electric car or hybrid vehicle, small electric drones and even large aircraft. ATEQ, with its technical focus and innovation culture, has found new ways to test these components for mass manufacturing.



The first basic component of every battery is a cell. A battery is a collection of cells. To keep the weight low, battery cells are frequently packaged in flexible pouches. ATEQ has developed a leak test method, patent pending, for testing these pouch cells using Ionized air technology. It allows for the testing of pouches, even without evaporating solvent.

The ionized air test can provide a leak test result for the whole pouch and it can also be used to locate the leak's location in the cell. For metallic body cells, ATEQ also has a test method that detects the evaporation of the solvent. Each battery cell has a semi-permeable membrane that separates the battery's plus and minus sides. This cell is flow tested prior to assembly to make sure the air flows through the membrane within the designated specifications and that there is not an unexpected hole in the membrane. Cells can be packaged together in a module with a protective envelope for easy handling.

At this stage, the module housing is generally not leak tight but sometimes a pressure decay leak test is used to test the module housing. ATEQ has a module balancer. A group of cells does not reach full charge if the cells are not at an identical charge level. The module balancer is used to even the charging level of cells during the manufacturing or maintenance process. The cells or modules are packaged together in leak tight protective housings to protect them against dust, water and mud splashing. It can be the 12 V battery of a classic internal combustion engine vehicle, a small bicycle rechargeable battery, or a fully electric vehicle car-sized battery. The leak tests all function similarly.

These battery housings and covers are tested for leaks separately before the cells/modules are mounted inside. If the housing is plastic, a differential pressure decay test with noise cancellation technology can be used to test for overall leaks in battery covers. If there is a desire to locate the defect in the cover, an ionized air leak test can be used. If the cover or tray is metal, only pressure decay technology with noise cancellation can be used. To locate leaks on a metal cover, a forming gas (H_2N_2) leak detection and localization with portable gas sensitive detector H6000 is the solution. ATEQ also proposes to automate this test with a smart holding robot.

Once the battery cells and modules are assembled in the housing, a final leak test needs to be performed. It can be done using a pressure decay or air mass flow technology with very low pressure drop sensors to quickly measure leaks. ATEQ's patent pending Differential Noise Cancelling DNC technology blocks out background conditions from the leak reading. The housing typically has a semi-permeable membrane that enables the air pressure to equalize with atmospheric and temperature changes. This semi-permeable membrane lets air through, but not water.

ATEQ has an air flow tester to test the breathing patch to ensure it is not double-stacked and that it did not get poked. The tester can also perform a wet test which puts air over water to detect smaller defects at the sub-assembly level. Some batteries have a check valve instead of a breathing patch that relieves the pressure generated by any gasses emitted during charging. This check valve is tested with air pressure to look for openings, "cracking" pressure and flow using an ATEQ ERD leak tester.

Some large battery housings can be equipped with a liquid cooling circuit. The cooling circuit is also tested for leaks with an air tester. For large battery failure analysis, a forming gas sniffer can be used to locate leaks since air leak tests cannot show leak locations. Gas sniffer leak tests are also useful for troubleshooting potential leaks in a fixture. The disadvantage of using a tracer gas leak test on large batteries is that the tracer gas can take a lot of time to mix with the atmospheric air inside a battery if there is no tracer gas current across the battery. It is recommended to fully evacuate the atmospheric air from the battery tray or cover prior to pressurizing it with tracer gas since the tray/cover cannot sustain much vacuum.

It is also recommended to monitor the tracer gas concentration on multiple sealed openings in the battery to verify that the tracer gas has reached every corner of the battery.

Based on ATEQ's experience with aviation battery testers, ATEQ can make custom battery testers that charge and discharge an entire battery. A fuel cell creates chemical energy by combining hydrogen, or any other combustible gas, with oxygen from the air and turning it into electricity for the vehicle.

The fuel side components are typically tested for leaks with a mix of 5% H_2 (hydrogen) and 95% N_2 (nitrogen) called forming gas. Contrary to pure hydrogen, forming gas is not flammable, and it helps detect defect areas that hydrogen could flow through. The air side is typically tested for leaks with an air pressure decay or mass flow instrument. The fuel cell's semi-permeable membrane should be tested for air flow and the vehicle's cooling system is leak tested with an air tester.

The upstream fuel storage and delivery systems are also tested for leaks, with air or forming gas, depending on the applications. The electric motors that operate the wheels are in leak tight housings that protect the motor against splashing water. A motor housing made of plastic can be tested using ionized air when it is not mounted. If the housing is metal, or fully assembled, it can be tested with air. The motor coil wires are coated with an insulating "varnish". At times, this "varnish" gets cracked, mainly where the wires are bent. ATEQ has developed a test to detect this defect using ionized air technology.

The new electric vehicles also come with automated driving assistance that uses sensors to feel the environment. Whether the sensors are cameras, lidar, or something else, the sensors are in leak-tight housings since they are exposed to the elements. ATEQ also tests the TPMS sensors (Tire pressure monitoring system), during wheel and vehicle assembly and at maintenance level. An air leak test is generally preferred to test these sealed sensors.

At times, a car battery cannot sustain a fast enough charge so the energy has to be stored in a large capacitor to keep it from breaking. ATEQ has an instrument designed to safely discharge these capacitors before servicing the vehicle.

In addition to the new electric vehicle leak testing applications, it is important to remember that many of the traditional automotive air leak testing applications still exist within an e-vehicle such as: brake systems, headlights, tail lights, ABS and central computer electronics, steering components and air conditioning systems for example.

BASED ON ATEQ'S EXPERIENCE WITH AVIATION BATTERY TESTERS, ATEQ CAN MAKE CUSTOM BATTERY TESTERS THAT CHARGE AND DISCHARGE AN ENTIRE BATTERY.

With the accelerated HEV/EV/PEV/Fuel Cell EV technology shift, OEMs must introduce new models to the market quicker than ever to stay competitive. However, this means that vehicle producers will face many new challenges during the manufacturing process such as: the increasing complexity of new vehicles, new technologies not yet fully mastered and the increased pressure to achieve the highest level of quality to avoid security risks and vehicle recalls.

To address these new challenges, ATEQ offers leak, flow, battery and TPMS testing instruments to ensure the quality testing of numerous components all throughout the EV vehicle manufacturing process.

ATEQ application engineers are familiar with existing electric vehicle leak test applications. They can also design a new leak testing solution for an application that has never been leak tested before. ATEQ has hundreds of experienced professionals who are trained in leak testing technologies. With offices and engineers all over the world, ATEQ is able to provide local assistance in developing the perfect quality testing solution for your application. \