WHITE PAPER

DEVELOPMENT OF DRIVELINE ELECTRIFICATION TECHNOLOGIES

intertek.com/automotive/electric-vehicle-testing

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EXECUTIVE SUMMARY

How will new powertrain electrification technologies perform as they age? What are the most cost-effective strategies for optimizing each system? And how can further improvements be made through integration of systems and more effective management of their interfaces? If the sale of electric vehicles is to accelerate to meet government and industry targets, these questions must be addressed quickly.

While some vehicle manufacturers and their suppliers have valuable experience with relatively cautious technology levels, vehicles that truly push the boundaries are only just coming to market. To ensure that they continue to meet the expectations of their owners (who are no longer the more tolerant early adopters), most are engineered with a significant degree of caution.

Only by understanding the in-service performance of each system and each component throughout a vehicle's life can these cautious specifications be transformed into weight savings, packaging improvements, faster charging, extended range and much-needed cost reduction.

Adding further complexity is the fragmentation of electrified powertrain technologies, already encompassing from 48 Volt to 800 V, with a range of approaches to the design and architecture of every system. In every area, innovation is being driven at an unprecedented rate, putting additional pressures on resources, budgets and timescales. Without rigorous testing at every stage, from research to development to pre-production to manufacturing conformity, the efficiency of development activities is compromised, and innovation becomes a synonym for risk.

The automotive industry has a wealth of experience that provides these insights for conventional powertrains. For electrified powertrains however, much of this roadmap is new and there are sufficient unanswered questions to require a fresh approach. For test engineers, it isn't just new techniques that are required: it is an understanding of the design challenges, the component interactions and the subtly different drivecycles of these nextgeneration vehicles. Test technologies must evolve at the same breakneck pace as the new EV powertrain technologies, and they must be adaptable to unique, continuously developing requirements.

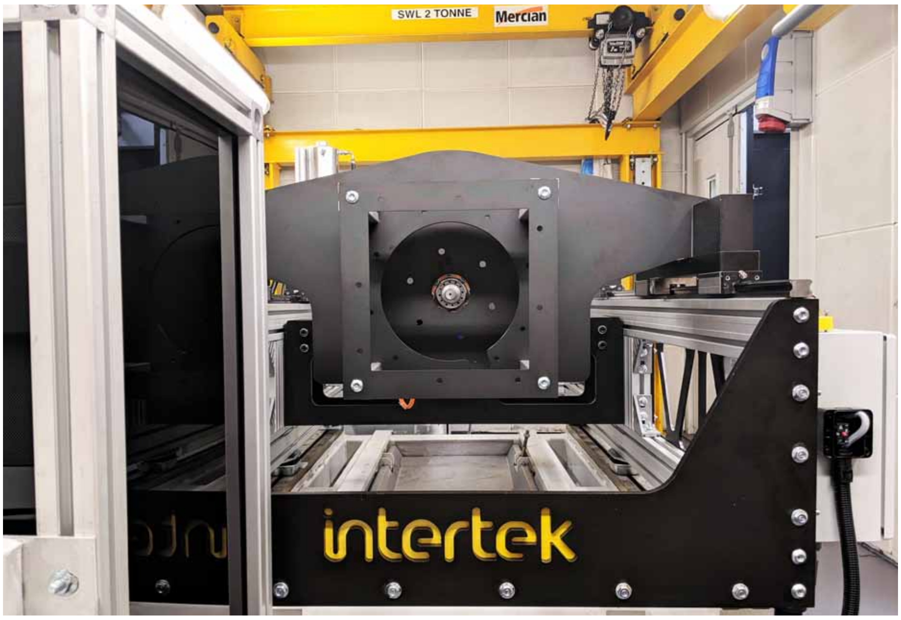
"TEST TECHNOLOGIES MUST EVOLVE AT THE SAME BREAKNECK PACE AS THE NEW EV POWERTRAIN TECHNOLOGIES."

What Intertek offers

Intertek is unique in offering local expertise across its global network of 1,000 locations in over 100 countries. As the world changes, operating safely, sustainably and delivering quality products and services becomes more difficult. Supply chains are rapidly growing in both size and complexity, bringing unprecedented levels of risk. In these challenging times, companies need a trusted partner.

Intertek's innovation-led, end-to-end Total Quality Assurance ('TQA') proposition is designed to support our clients 24/7, providing – on a global scale – a fully integrated portfolio of Assurance, Testing, Inspection and Certification services to give our customers complete peace of mind for their products and services.

With our unique Total Quality Assurance offering, we make the world a safer, better and more sustainable place.



"ACCELERATING INNOVATION REQUIRES TESTING MUCH EARLIER IN THE DESIGN CYCLE."

THE DEVELOPMENT CHALLENGE

We begin this white paper by discussing the challenges that must be considered before any next-generation electric or hybrid vehicle powertrain programme should begin: do you know what questions to ask?

The first generation of 'modern' electric vehicles largely followed the established architecture of an engine (motor), a transmission (although invariably single speed) and a control system. From there, the technology roadmap becomes more exciting, and substantially more fragmented. As governments are forcing the introduction of pure electric vehicles, with the UK currently consulting on a 2035 (or possibly even a 2032) ban on the sale of all new vehicles with Internal Combustion Engines (ICE), the global market for electrified ICE vehicles continues to grow. Bloomberg NEF predicts it will be 2040 before battery electric vehicles account for more than 50% of global new car sales. Twenty years from now, half of all new cars will still have an internal combustion engine, but almost all of them will have some degree of electrification.

Whether a full EV, a full hybrid or a mild hybrid (or a plugin hybrid), optimising the powertrain as a single system will be vital to achieving increased range without the cost, weight, packaging and environmental penalties of larger batteries. Discussing this topic in the context of battery electric vehicles, the UK Government's propulsion systems technology roadmap states: "The strongest theme underlying all of the technology road mapping workshops was that maximum powertrain and vehicle efficiency will only come from optimizing the sperate technologies coherently as a whole system." The section concludes that improved simulation and testing are vital if the technical targets are to be met within the available resources and timescales.

Clearly, this introduces additional test system challenges: not only must each fast-evolving powertrain system be understood and optimized at a component and subsystem level, all their interactions must also be understood and optimised. It is for this reason that Intertek, the world's largest specialist in vehicle test and certification, concluded that only a new, purpose-built EV/HEV powertrain test facility would deliver the answers needed by vehicle engineers addressing these complex questions.

E-MACHINES

Like most engineering systems, e-machines can be optimized for cost or performance. Unlike mature technologies, however, the ability to achieve both together to meet the needs of volume markets is in its infancy. The need for targeted R&D is clear.

To meet its objectives, the e-machine community will have to explore new materials, new manufacturing processes and new architectures: a rate of change that requires very careful progress, validated by robust data at every stage.

A particular challenge for E-Machine design is the need to reduce dependency on expensive materials that often have unstable or questionable origins. This can be achieved through materials substitution, such as finding alternatives to the heavy rare earth metals that are added to improve the temperature resistance of neodymium, and through efficiency improvements that reduce the requirement for these materials. This latter can be achieved through improved magnetic design, e.g. by reducing the airgap in IPM motors, and by more effective thermal management, either by generating less heat (efficiency improvement) or by cooling improvement (e.g. force-cooled rotors).

Improving the properties and application of magnetic materials allows thinner laminations and can reduce eddy current losses, but this can only be achieved with a robust understanding of the impact of change on their durability and high temperature stability. The challenge is compounded by the parallel trend to increase power density by increasing spin speeds. Today's production motors typically operate up to 15,000 RPM, but Intertek is already working with clients on speeds up to 25,000 RPM and is installing test systems rated for E-Machines operating at up to 27,000 RPM, with higher speeds already planned.

Another important technique for improving efficiency while reducing weight, cost and packaging volume is the development of increasingly integrated Electric Drive Units (EDU) that combine the E-Machine, Power Electronics and transmission. While relatively easy to integrate three subsystems into one physical unit, the challenge is to take another big step and design the EDU as a single, highly optimised system.

Each step towards more efficient integration requires not just a deeper understanding of each system, but also of their interfaces and interactions. Physical integration is clearly fundamental, but this brings additional EMC issues and the question of how to manage the thermal requirements of such diverse systems. Air cooling is a popular low-cost solution for mass market BEVs, while higher performance vehicles already use water-based cooling or a combined cooling and lubrication loop for the EMachine. The future will bring a new generation of fluids developed to provide high thermal conductivity, low viscosity lubrication and high dielectric strength, allowing much greater integration of cooling and lubrication circuits for all three systems. Despite the higher operating temperatures of new semiconductor materials, system level thermal management strategies need substantial further development.

Across all these areas, especially materials selection and manufacturing techniques, new approaches must also consider the need for end of life recycling. This features prominently in the UK government's technology roadmaps and is also commercially essential to return precious metals to the supply chain, increasing the stability of both price and supply. Sustainability, addressing whole-life impact, will become an increasing design requirement.

DATA HANDLING

High speed motors require very highspeed data collection (into the MHz range), alongside the need for considerable flexibility to accommodate a wide range of sensors. The challenge is to collect and manage this data efficiently, without great capital cost or time cost.

The solution is a combination of highperformance design of the control and data acquisition system, intuitive graphical user interfaces and development environments that eliminate the need for low level programming. This approach allows fast, multichannel data collection, storage and processing, with fast, precise set-up to maximise the range and quality of information achieved from each test.

Owning the test system IP allows fast set-up and customization without dependence on a third-party vendor. At Intertek, this approach is applied across all major test systems and clients can have data access and supervisory control from anywhere in the world.

Test requirements

Our analysis of the test requirements for E-Machines has identified the following areas in which progress in test techniques will help to facilitate progress in system technology:

- Very high-speed operation
- Very high wheel torque with aggressive transients
- Thermal management including hot spot mitigation
- Integrated cooling loops with different media
- Migration from three phase operation to six or nine phases
- New magnetic materials and their impact on efficiency and durability
- New e-machine architectures

As with all automotive test operations, these must be explored across all likely operating conditions, from extreme heat to extreme cold, dust, salt, vibration and driver abuse. A further complication is the range of vibrations to which e-machines are subjected when implemented within a hybrid powertrain. Even within an EV, the location of each system will substantially change the input profiles.

Finding incremental design improvements, particularly at high motor speeds, requires great precision so that small effects can be studied repeatably. For this reason, direct drive e-machine dynamometers are preferred; a technology that Intertek has been driving forward with its test system suppliers. The higher positive and negative transient torques experienced by E-Machines require particular attention to the stability and durability of the equipment.

There is also additional complexity in the energy supply. For ICE testing, fuel is generally of consistent specification (if we ignore the challenges of poor fuel quality faced in a surprising number of markets) and although volatile, is relatively safe to store and handle. Batteries have a different range of issues, including failure mechanisms that can be hazardous. For this and other reasons, the propulsion battery is generally replicated by a battery emulator: a system that provides the required voltage and current directly from the supply, without chemical storage.

This approach also eliminates the variability associated with chemical storage, allowing much more repeatable results, but it does require an accurate understanding of the battery characteristics and the responses and strategies of the Battery Management System. Changes in current, for example, can be fast and substantial, so the emulator must precisely replicate the response of the battery system. It must also be able to cope with variable inductance loads whilst maintaining tight control of voltage to prevent over or under-shoot from target voltage set points.

An enhanced understanding of E-Motor subsystems can also lead to significant efficiency gains, often through relatively simple design improvement without additional manufacturing or materials cost. Again, the skill required is not just in the development of a bespoke, highprecision test system, but also in understanding how to specify the test conditions and parameters to accurately reflect real-world usage.

An example is energy losses caused by movement of the fluids used for cooling and lubrication. Intertek found that with no third-party technique available, investigation required the development of a bespoke test system, using a custom twist beam sensor to provide torque measurement to +/- 0.001 Nm. To ensure correlation with real-world usage, Intertek also developed a bespoke oil conditioning system and a technique for heating the stator that contributes to making this a unique test capability. Another example is the measurement of spot temperatures, which can require non-contact temperature sensors with galvanically isolated data acquisition systems.

The same approach is used to ensure that each test programme delivers the maximum possible value for the client by gathering as much useful data as possible from each test. E-Motor test systems, for example, can include measurement of NVH (Noise, Vibration & Harshness) and non-intrusive infrared measurement of bearing and rotor temperatures. It is also valuable to take high fidelity power analysis measurements as characterization of power consumption early in the design phase can provide invaluable support for the development of other systems.

"FINDING INCREMENTAL DESIGN IMPROVEMENTS, PARTICULARLY AT HIGH OPERATING SPEEDS, REQUIRES GREAT PRECISION SO THAT SMALL EFFECTS CAN BE STUDIED REPEATABLY."

POWER ELECTRONICS

Voltage is another excellent example of the diversity of technology choices. The trend for full EV (and to some extent, full hybrids) is currently very clearly towards higher voltages. Following the launch of the first 800 V electric vehicle at the Frankfurt show in 2019, technology suppliers are already discussing programmes 'beyond 1,000 V'. While that is undoubtedly an excellent solution for efficiency, charging time and energy capture, as well as reducing the size and weight of cables, it introduces a wide range of potential issues that must be understood and validated to an exceptional degree.

The other significant trend is to high band gap semiconductor materials such as silicon carbide, operating at much higher temperatures than the conventional silicon they displace. Currently in production only in high-end applications, it is likely that the technology will become more common thanks to its ability to enable more efficient motors and to reduce the packaging and cooling requirement of the Power Electronics.

Test requirements

Our analysis of the test requirements for Power Electronics has identified the following areas in which progress in test techniques will help to facilitate progress in system technology:

- Flexibility to address voltages from 48 V to beyond 1,000 V
- Scalability to address future power increases
- Thermal management using a choice of media
- Migration from three phase operation to six or nine phases
- Fast integration of prototype control software
- Very high-speed data collection
- Comprehensive understanding of EMC issues

Even by vehicle electrification standards, the rate of progress of Power Electronics technology is impressive. For test engineers, this is a significant challenge that requires very high levels of flexibility and scalability to ensure new technologies can be quickly accommodated; in-house system customisation is vital to eliminate the time lag introduced by dependence on a specialist supplier. With very little historical precedent to help design test programmes, the expertise of the test engineer is particularly critical to ensure a representative programme that addresses the relevant design criteria.

Ensuring a test accurately reflects real-world operation also requires attention to be paid to the test environment, especially to minimize electrical noise and electromagnetic interactions that are not representative of those that will be experienced in the vehicle. The interaction of the motor with the power electronics is also complex, requiring precise, high-speed power analysis for accurate characterization and again, an experienced test engineer to ensure the total system is fully representative.

DATA HANDLING

Power Electronics test systems require very high-speed data acquisition, with this requirement increasing to accommodate the trend to high speed IGBT switching devices. Again, there are complex interactions. For example, switching around 20 KHz can introduce unwanted harmonics up to MHz frequencies in the AC cables and a high amplitude gain overlaying the data. This requires careful specification of the Data Acquisition System and even more careful data processing.

Characterising high power electrical switching will require high power sources and loads and real-time modelbased control and measurement that is an order of magnitude faster than data collection systems

WHOLE VEHICLES, TRANSMISSIONS AND DRIVELINES

Transmissions and Drivelines are another area where there is growing diversity of technical solutions. Transmissions may be standalone or integrated with the e-machine, which may be standalone or integrated with the transmission or with the axle. Multispeed transmissions are already being introduced for high performance electric vehicles and will soon cascade into higher volume sectors and commercial vehicles.

In all areas, efficiency is receiving considerable attention, at both a system level and a component level. Bearings, gears, oil spin losses and seals are amongst the areas where an increased understanding of behaviours is enabling valuable incremental improvement. In each of these, there is a trade-off that must be understood and verified through testing: with gear design, for example, the more helical the gear profile the easier it is to create a silent transmission, but the more energy is wasted in sliding contact. Low loss fluids will make a growing contribution and significant work is being conducted here with the oil and additive suppliers.

Another interesting development is the rise of 48 V systems. Once thought of as a steppingstone to full hybridization, the technology roadmap now reaches to full zero emissions capability, with the potential for four-wheel drive and added value features such as torque vectoring for very little additional cost.

While the 48 V electric machine is increasingly likely to be highly integrated with the transmission, as we are seeing in recent passenger car launches, this is just one of a growing diversity of 48 V system architectures. Beyond this, we are seeing individual axle motors and anticipate the introduction of hub motors. Intertek is also working on a growing range of 48 V systems in motorsport, off-highway vehicles and non-automotive applications.

"WITH VERY LITTLE HISTORICAL PRECEDENT TO HELP DESIGN TEST PROGRAMMES, THE EXPERTISE OF THE TEST ENGINEER IS PARTICULARLY CRITICAL"

Test requirements

Our analysis of the test requirements for whole vehicles, transmissions and drivelines has identified the following areas in which progress in test techniques will help to facilitate progress in system technology:

- Drivecycle analysis including torque pattern characterisation
- Noise, Vibration and Harshness
- System and Subsystem efficiency
- Lubrication and cooling system losses
- Fast integration of prototype control systems and software
- Very high-speed data collection
- Precise analysis of component performance
- Comprehensive understanding of EMC issues

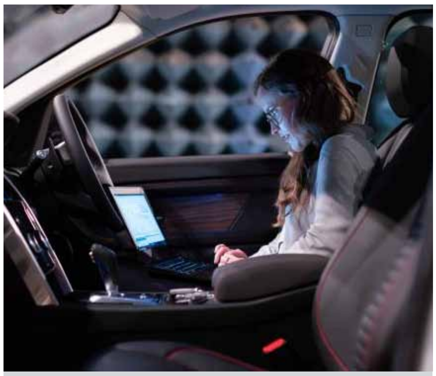
Early electric vehicles, without regenerative braking, could be tested on a conventional chassis dyno as the energy flow was one way. Since the introduction of regenerative braking, specialist dynamometers are required to provide fast modulation of positive and negative torque. The high current flows in each direction also add the complication of back EMF and other EMI issues.

The next step, already implemented at Intertek, is the introduction of hub dynos. The many advantages of this technique include:

- Increased consistency through direct engagement with the driveline, removing variability from tyres (pressure, temperature, wear, design), tyre slip and strap tensions
- Precise transient responses, e.g. to measure wheel slip and calibrate torque vectoring
- Ability to measure speed differences across each axle
- Low inertia allowing accurate simulation of highly dynamic drivecycles

A well-designed dyno should also offer two or four-wheel drive capability and the ability to operate E-Machines at different voltages on each axle. They must also be far more robust than their ICE counterparts, as very high transient torque loads place tough demands on equipment reliability and must not be allowed to introduce inaccuracy through unwanted movement in the rig or driveline components.

Multispeed transmissions will require more traditional durability analysis, but even here the conditions are more extreme, with higher torque, potentially from a 'cold' start, very fast shifting and fast control systems. As with E-Machines, lubricants have a significant impact on efficiency so should also be studied as small physical changes can significantly reduce energy losses.



"THE HIGH CURRENT FLOWS IN EACH DIRECTION ADD THE COMPLICATION OF BACK EMF AND OTHER EMI ISSUES."

BATTERIES

It is generally agreed that Li-ion batteries will dominate the current vehicle design cycle and the next, partly because they are currently by far the most attractive energy storage technology but also because they are also the most understood; a key factor in a market where the speed of new model introduction is critical.

However, if performance targets are to be met, Li-ion batteries will require substantial improvements in charging rates and useable power density. Key to achieving this (in addition to improved cell chemistries) will be progress in control strategies, thermal management and cell diagnostics. Much development is required.

The big questions are around the environmental challenges associated with the manufacture of lithium ion batteries and their end of life recycling. As zero tailpipe emissions become the norm, life cycle impact will become the focus of attention. Li-ion batteries currently perform poorly under that measure. While solving the end of life challenge is largely a process issue for the recyclers, it is important to simplify their challenge through design improvement and materials substitution. Again, these are new fields that require careful research, development and validation.

Test requirements

Our analysis of the test requirements for batteries has identified the following areas in which progress in test techniques will help to facilitate progress in system technology:

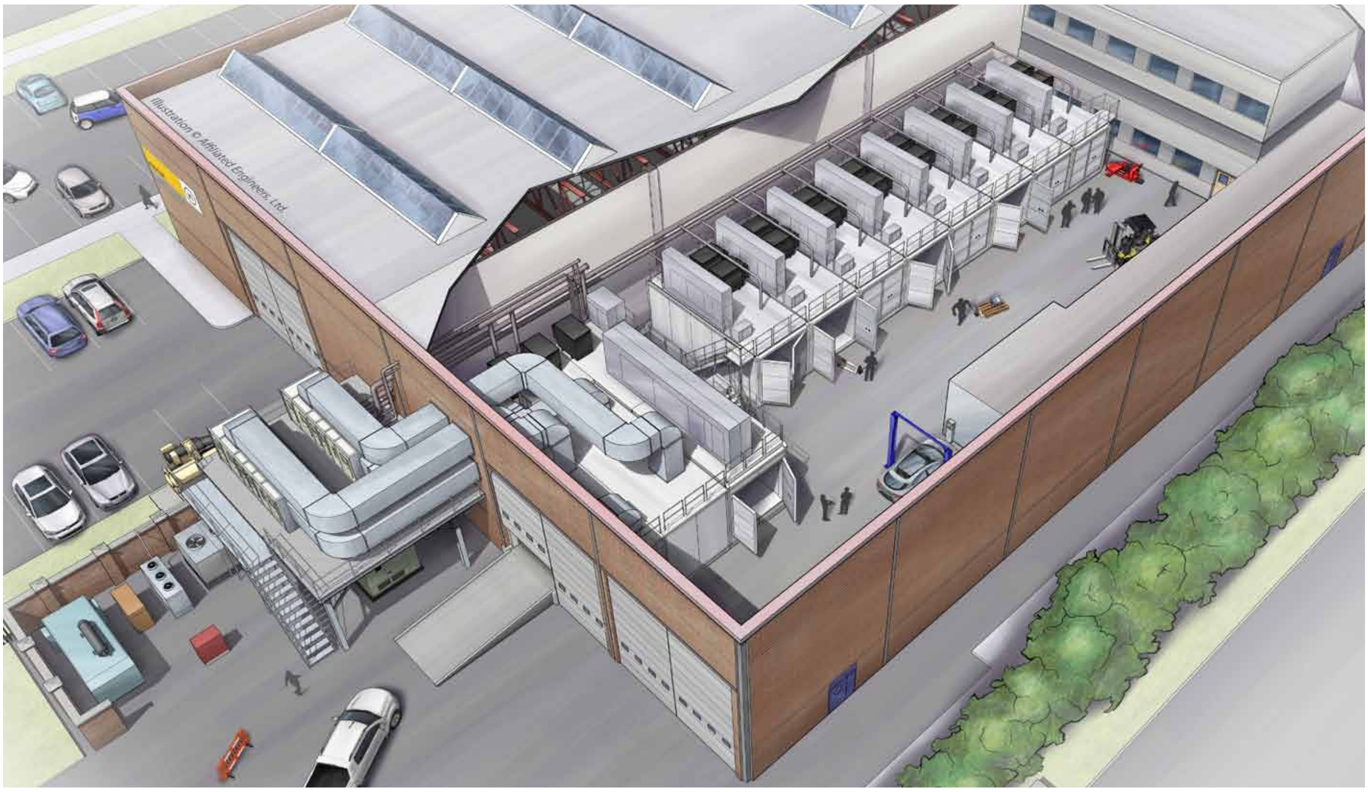
- Cell, Module and Pack level capability
- Cycle life analysis including the impact of thermal cycling regimes
- Hybrid Pulse Power Characterisation
- Thermal management using a choice of media
- Climatic conditioning and rapid temperature change
- Fast integration of prototype BMS and control software
- Physical robustness and safety
- Electrical abuse and safety
- Very high-speed data collection
- Comprehensive understanding of EMC issues

The challenges associated with battery testing fall into three areas, two of which must be addressed before the third, the characterization of battery performance and behaviour that is the objective of the test, can be achieved. These are the safety of people working around prototype battery technologies and ensuring that the interactions with the E-Machine, the Power Electronics and the electromagnetic environment are all representative of real-world usage.

Physical testing of batteries, while equally important, is considered to be a separate topic as it requires different skill sets and equipment that are available within the Intertek group, including UN38.3 transportation testing and certification, environmental testing and abuse testing.

Recognising that this is a fast-evolving area where the battery suppliers already have significant strength, Intertek is researching the requirements of vehicle manufacturers and powertrain suppliers and will design its battery testing capability as part of Phase 2, based on the requirements of those who will benefit from the most progressive test technologies.

NEW FACILITY: EUROPEAN EV PROPULSION TESTING CENTRE OF EXCELLENCE



In August 2019, Intertek announced that it is creating a new European Centre of Excellence for the test and development of automotive electric propulsion systems.

As the world's most comprehensive testing and certification partner, with more than twenty years' experience working with vehicle manufacturers and technology suppliers on EV programmes, the company has brought considerable expertise to the design of this new facility. Intertek has also called on the vision and experience of electrification specialists throughout its client businesses to ensure that the new laboratories will accommodate the fast-changing requirements of this demanding sector.

The new facility will therefore encompass 32 test cells, covering ten different major techniques and a range of subsidiary techniques for the test and development of E-Machines (at up to 27,000 RPM), Power Electronics (up to 1,100 V), integrated axle modules and on-board vehicle electrical systems. Flexible test programmes will provide insights at component, system and systems integration levels. Complementing the component and systems laboratories, there will be a four-wheel drive full vehicle climatic test chamber that is believed to be the first independently available facility of its type in Europe. Further development is planned, adding battery test laboratories and additional facilities for EV system testing.

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Fast and flexible

The ability to deliver high-quality insights that accurately reflect real world usage is partnered with a focus on accelerating the development process. The new facility is structured for remote set-up so test cells can achieve very fast turnaround, and a high level of automation is specified to allow safe 24/7 operation. Because electrification technology is evolving so quickly, with many questions as yet undefined, there will be a substantial in-house design and build capability so that rigs can be quickly modified, or all new rigs designed and built, to allow new areas of investigation.

Every test cell and laboratory is designed to accommodate the specific requirements of these new technologies. Electrical noise has received particular attention as Intertek's experience suggests it is an area that can have a significant effect on the results yet is often given insufficient consideration. New systems have also been developed to ensure environmental correlation, for example a bespoke climatic soak system that can cost-effectively bring a test system down to -40oC before the test piece is moved to the cell.

"THE DIFFERENCES BETWEEN ICE AND BEV DRIVECYCLES CAN BE SURPRISINGLY CRITICAL."

Real world correlation built on experience

However well planned a test laboratory may be, it's results will only be as good as the understanding of real-world usage against which it correlates its procedures. The differences between how conventional and battery electric vehicles are driven can be surprisingly significant, requiring a fresh look at drivecycles.

An example is the application of the motor's often generous torque, which is typically available from zero RPM and could be applied after a considerable time standing. How often will this event occur? What will be the pattern of torque transients be when there is no powertrain noise to deter aggressive acceleration?

One of Intertek's specialist groups is researching this question, developing a substantial database of real-world EV drivecycles. Their results show some surprising differences between EV and ICE driving characteristics: knowledge that is helping to ensure the results we deliver are tightly correlated with real-world usage.

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THE INTERTEK ADVANTAGE

One of the challenges with the development of any new technology is the range of expertise required to make it ready for volume production. In a relatively new field such as EV powertrain, some of these requirements may be unscheduled, required to answer questions revealed by testing but without time in an already hard-pressed programme.

With more than 1,000 laboratories and offices worldwide, Intertek can provide a complete, end-to-end test programme that can adapt quickly to developing requirements.

Recognising the quality of Intertek's capability, the UK government's South East Midlands Local Enterprise Partnership (SEMLEP) has provided funding the support the development of the new European Centre of Excellence for the testing of automotive electric propulsion systems.

To learn more about solving the test and development challenges of electric and hybrid vehicles, follow the progress of Intertek's state-of-the-art facility on LinkedIn
linkedin.com/showcase/intertek-transportation-technologies/

OUR INDUSTRY-LEADING CAPABILITIES

The new Centre of Excellence will be a hub through which a wide range of complementary specialists are accessed to quickly deliver the complete range of technical insights needed by powertrain engineers with deadlines that cannot be missed.

Intertek's specialists have assessed more than 20,000 batteries for performance, durability and safety. They analyse more than 1,000 oil samples a year, dismantle transmissions and axles to study wear, operate a network of impressive Non-Destructive Testing Laboratories and the world's largest network of EMC test laboratories. Corrosion, materials, vibration, dust intrusion, salt spray and a host of other complementary techniques can be accessed in all major markets, together with laboratories for EV charging and electrical safety.

The investments in future mobility technology continue, with the recent opening of a brand-new 500-acre facility for the development of autonomous and connected vehicles including heavy duty trucks, ready for the next generation of new automotive technologies.

THE COMPLETE TOTAL QUALITY AUTOMOTIVE INDUSTRY SOLUTION

Assurance, Testing, Inspection and Certification

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AUTONOMOUS & CONNECTED VEHICLES

Achieve compliance with all testing and design criteria required to launch your autonomous vehicle solution, including: DSRC testing and certification, ADAS testing, track and road fleet testing, functional safety and vehicle homologation services.

COMPLETE SUSTAINABILITY SERVICE SOLUTIONS

We work with customers on unique end-to-end solutions that includes our wide variety of sustainability services and independent certifications to manage your risk and resilience in your operations and supply chain, whilst supporting your ability to operate effectively and act responsibly.

ELECTRIC VEHICLES & EVSE

As a world leader in testing and certification of electric vehicles and related charging systems, we are fully invested in the areas of renewable and clean energy. This allows you to bring your products faster to these rapidly growing markets. Including local & global certifications and eMotor validation solutions.

VOLATILE ORGANIC COMPOUND (VOC) & RESTRICTED SUBSTANCE EVALUATION TESTING

We are accredited for material testing by automotive market leading OEM(s) and work with customers on VOC issues to minimize problems before they arise in the field by providing VOC and aldehyde-ketone emission testing for materials and products.

ENGINE & GEARS

Our testing services for automotive engines and drivetrains help to develop optimal products, and we offer a variety of options for products used in passenger cars, trucks and high-performance engines sectors for gasoline, diesel and alternative fuels.

ELECTRICAL COMPONENTS & SYSTEMS

Ensure that your systems and components are compliant with SAE, OEM, E/e-Mark, EMC and other related national and regulatory standards.

ENVIRONMENTAL TESTING

The range of simulated and accelerated environmental testing options we offer brings your automotive products an assurance that they are ready to weather any environmental challenges that may come, rain or shine, fog or humidity, mechanical vibration & shock, or even freezing temperatures and corrosive salt.

VEHICLE TESTING SERVICES

Our in-lab, closed course (track), and on-road fleet testing solutions provide Total Quality Assurance for both passenger and heavy-duty vehicles. We offer mileage accumulation programs virtually anywhere on the planet in any climate, or dedicated time on a closed-course, proving grounds.

FUELS & LUBRICANTS

We are a leader in additive, lubricant, and engine oil testing for standardized gasoline and diesel engines, engine endurance and durability testing, fuel additive & alternative fuel testing, and sealed housing for evaporative emission determination (SHED) fuel system services testing. With comprehensive engine oil testing services, we provide a pathway to American Petroleum Institute (API) engine oil licensing and certification.

COMPOSITES, PLASTICS & METALS

We support developers and manufacturers of automotive materials with expertise in the field of plastic materials, composites, components and metal. Intertek experts understand the behavior and properties of automotive materials and have the latest laboratory equipment and techniques.

Intertek is a leading Total Quality Assurance provider to industries worldwide. Our network of more than 1,000 laboratories and offices and over 46,000 people in more than 100 countries, delivers innovative and bespoke Assurance, Testing, Inspection and Certification solutions for our customers' operations and supply chains. Intertek Total Quality Assurance expertise, delivered consistently with precision, pace and passion, enabling our customers to power ahead safely.

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