HyperHybrid
The Smarter Electric Vehicle
OBRIST HyperHybrid

Welcome to OBRIST Powertrain

OBRIST Powertrain is an Austrian engineering company focused on developing key components for hybrid electric and battery-powered vehicles.

Our components and systems are compact, simple, and incredibly cost effective. We offer scalable solutions perfectly suited for a variety of requirements, from affordable mass-market mobility solutions to premium segments.

In 2011, OBRIST Powertrain was founded as a natural extension of OBRIST Engineering, which had been working on eco-friendly thermal management solutions since 1996. Our proprietary powertrain HyperHybrid developed out of an intensive cooperation with the automotive industry and the desire to accelerate the market penetration of efficient alternative propulsion systems. This concept can significantly reduce the carbon footprint of worldwide mobility.

We provide a plug-in hybrid electric powertrain solution that boasts maximum energy efficiency and unmatched compactness and pricing – thanks to a smart and simple design that incorporates a multitude of functions. The OBRIST team is a committed group of individuals with strong backgrounds in all major technical disciplines, especially thermal management, hybrid electric drivetrain development and control technology.

Creating tomorrow’s sustainable mobility.
We no longer need to worry about the environment.
HyperHybrid Powertrain

Series Hybrid Powertrain

Customers are intrigued by electric vehicles but suffer from range anxiety. Trips must be carefully planned based on the charging infrastructure available. HyperHybrid – a series hybrid powertrain solution – combines electric driving with unlimited range at maximum efficiency and affordable costs.

The HyperHybrid powertrain features an ultra-compact combustion engine boasting unmatched efficiency, a high-power, low-cost battery based on 18650 cells, and integrated thermal management covering the complete powertrain and the passenger cabin.

Customers can now decide whether or not to plug in the vehicle; it is no longer mandatory. The combustion engine with integrated generator is always able to provide energy for driving the vehicle without compromising performance or efficiency.

Accessing Various Segments

The ultra-compact drivetrain components can be integrated in various vehicle segments – even in small cars. In larger vehicles, Zero Vibration Generator provides an extra 250mm of bay space that can be used for increased passenger comfort or additional seating capacity. The compactness of the components significantly improves packaging freedom for automotive designers and engineers.

Pure Driving Passion and Comfort

- Electric rear-wheel drive with high torque for maximum driving passion
- Highest levels of NVH comfort comparable to battery electric vehicles (BEV)
- Packaging enables low center of gravity and perfect mass balancing between front and rear

The solution for global automotive mass markets.

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Zero Vibration Generator: 40kW
High Voltage Li-Ion Battery: 17.3kWh
100kW Electric Motor/Inverter
The HyperHybrid powertrain is installed in a fully functional demonstrator that has undergone intensive bench and road testing. The demonstrator represents the global mid-size car and is designed for a top speed of 161km/h (145km/h continuous). The Li-Ion battery has an electric battery range of 98km under the NEDC.

The operating strategy utilizes battery power in the city and switches to hybrid mode on highways (ZV-Generator on). The innovative Zero Vibration Generator concept is responsible for BEV-comparable NVH values.

Our proprietary HyperHybrid control unit manages energy fluxes in the hybrid system and takes care of thermal management, brake energy regeneration, and the Zero Vibration Generator operating strategy. Algorithms and hardware are designed at OBRIST Powertrain.

**Benefits**

- Price comparable to common gas/diesel drivetrains
- NVH comfort comparable to BEV
- Significant weight reduction compared to BEV
- Plug-in chargeable but not mandatory
- No range anxiety
- Battery range meets requirements for government subsidies

You are invited to test drive the future.
Zero Vibration Generator

The Zero Vibration engine.

Leading Energy Efficiency

The Zero Vibration Generator is a generator-integrated combustion engine boasting best-in-class efficiency and packaging.

Its ultra-compact design is reduced to the essentials. This goes hand-in-hand with a lightweight construction, and low assembly and maintenance costs.

The engine incorporates a control unit, inverter, and generator. Its compact design and integration of multiple functions reduces costs.

Superior NVH Behavior

Special emphasis was placed on noise and vibration reduction during the design phase of the Zero Vibration Generator.

To overcome the vibration challenges of a two-cylinder engine, a novel twin crankshaft configuration was selected. Contra-rotating crankshafts allow for optimized mass balancing. Generator and engine noise is also reduced thanks to the combined acoustic and thermal insulation. This insulation allows the thermal management system to use the engine as a heat source when temperatures are at their lowest.

Application

With its engine characteristics, the Zero Vibration Generator is an ideal power source for electrifying vehicles. It is perfect for powering a series hybrid vehicle.

Due to its compactness and design features, the engine’s mounting position can be arbitrarily selected, providing automotive engineers with unprecedented freedom in hybrid powertrain packaging.

Key Facts

- Symmetrical generator and main drive position
- Contra-rotating crankshafts (balancing of 1st order)
- Double speed contra-rotating generators (balancing of 2nd order)
- Full load operation at λ=1: lowest cost for emission aftertreatment
- Lowest NOx and PM issues due to simple intake manifold fuel injection
- Capability to fulfill more stringent future emission regulations

The Zero Vibration Generator: Baseline Technical Data

- Generator power: 40kWe
- Engine displacement: 999ccm – multi-fuel calibration
- Four stroke two-cylinder engine – naturally aspirated
- SFC DC: 258g/kWh
- Engine weight (without fluids): 95kg
- Compact design: 677 x 498 x 188mm

The Zero Vibration Generator: High-Power Technical Data

- Generator power: 85kWe
- Engine displacement: 999ccm – multi-fuel calibration
- Four stroke two-cylinder engine – turbocharged (Liquid Charge Air Cooled)
- SFC DC: 236g/kWh
- Engine weight (without fluids): 120kg
- Compact design: 677 x 498 x 238mm

Vibration Comparison for Fully Balanced Engines

<table>
<thead>
<tr>
<th>Engine</th>
<th>Power (kWe)</th>
<th>Displacement (ccm)</th>
<th>Crankshafts</th>
<th>Balancing (Order)</th>
<th>Mass Balancing (N)</th>
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</thead>
<tbody>
<tr>
<td>ZVG (999ccm)</td>
<td>40</td>
<td>999</td>
<td>2</td>
<td>0</td>
<td>1568</td>
</tr>
<tr>
<td>V90 (999ccm)</td>
<td>85</td>
<td>999</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>S90 (999ccm)</td>
<td>85</td>
<td>999</td>
<td>3</td>
<td>1 balancing shaft</td>
<td>0</td>
</tr>
<tr>
<td>S90 (999ccm)</td>
<td>85</td>
<td>999</td>
<td>4</td>
<td>2 balancing shafts</td>
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Brake Specific Fuel Consumption

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<tr>
<th>Engine</th>
<th>Conventional</th>
<th>ZVG + HPIS</th>
<th>ZVG + HPIS + Lean (λ &gt; 2)</th>
<th>DMC+ (Dimethyl Carbonate with Additives)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 rpm</td>
<td>256</td>
<td>225</td>
<td>200</td>
<td>180</td>
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<tr>
<td>2000 rpm</td>
<td>200</td>
<td>180</td>
<td>156</td>
<td>140</td>
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<tr>
<td>2500 rpm</td>
<td>160</td>
<td>130</td>
<td>106</td>
<td>90</td>
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<td>4500 rpm</td>
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<td>5</td>
</tr>
<tr>
<td>5000 rpm</td>
<td>10</td>
<td>5</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

DMC+ = Dimethyl Carbonate with Additives

[Graph showing Brake Specific Fuel Consumption (BSCF) with different fuels and settings, including ZVG, ZVG + HPIS, ZVG + HPIS + Lean (λ > 2), and DMC+.]
High Voltage Li-Ion Battery

More Energy – Less Weight

OBRIST Powertrain batteries for PHEV and BEV applications are designed to fulfill customer expectations mostly related to increased specific energy and reduced costs.

For instance, our 17.3kWh Vacuum Fixation Technology battery reaches the specific energy density level of 177Wh/kg, an increase of 29Wh/kg over the previous generation.

Cost Reduction

The most significant factor here is the choice of commodity – 18650 cells that are available at very low costs compared to prismatic or pouch-type Li-Ion cells. For the housing, we use lightweight aluminum at only 2mm thick. In addition, the whole system was designed with a strong focus on excellent component integration to reduce complexity and material costs. The battery architecture has been tailored to automated production to achieve an extra level of reliability.

Design Features

- Innovative Vacuum Fixation Technology
- Thermal insulation for better service life and performance
- Low cost and high flexibility with 18650 cells (pouch optional)
- Air cooled design (liquid cooling optional)
- Low weight with highest specific energy density values
- Lightweight aluminum housing (2mm thick)
- Master/Slave Battery Management System with wireless voltage sensing
- Full mounting flexibility

Key Facts

- Vacuum Fixation Technology
- Lightweight aluminum housing (2mm thick)
- Battery weight: 98kg
- Dimensions: 1017 × 359 × 166mm

Technical Data:

- High power: 17.3kWh with 3000mAh
- Nominal voltage: 360VDC (420V–240V)
- Continuous discharge power: 110kW (200kW pulse)
- Continuous charge: 26kW
- Specific Energy Density: 177Wh/kg (module only 203Wh/kg)
Your hybrid and battery technology partner of choice.
High Performance Version

HyperHybrid for Premium Segments

Our high-performance drivetrain solutions are focused on premium vehicle segments. This powertrain concept is derived from OBRIST Powertrain’s mass-market components and comes in various versions with different performance levels. With a variety of component configurations anything is possible, for example, two- or four-wheel drive.

Perfect Mass Balancing for a Superior NVH Performance

- Turbocharged combustion engine with 85kWe provides consistent high power
- Two-generator/inverter design for a fully balanced engine
- Better NVH comfort than a V12 engine

Battery System

For higher battery electric power and longer battery electric ranges, the installed battery capacity has to be enlarged in this drivetrain concept.

Zero-Vibration Generator: High Power 85kWe

200kW Electric Motor/Inverter

High Voltage Li-Ion Battery: 25 kWh
Affordable

Flexibility

Comfort

Safety

Compact

Efficiency

Low complexity

Smart and simple

Reliability

Beneficial

Future mobility

Electric drive

Technology

Superior NVH

Plug-in chargeable

Improved lifetime

Innovative

Modularity

Series PHEV

Energy density

Thermal management

Progress and change

Drive passion

Low-cost

Low complexity

Future mobility

Electric drive

Technology

Future mobility

Electric drive

Technology

Future mobility

Electric drive

Technology