



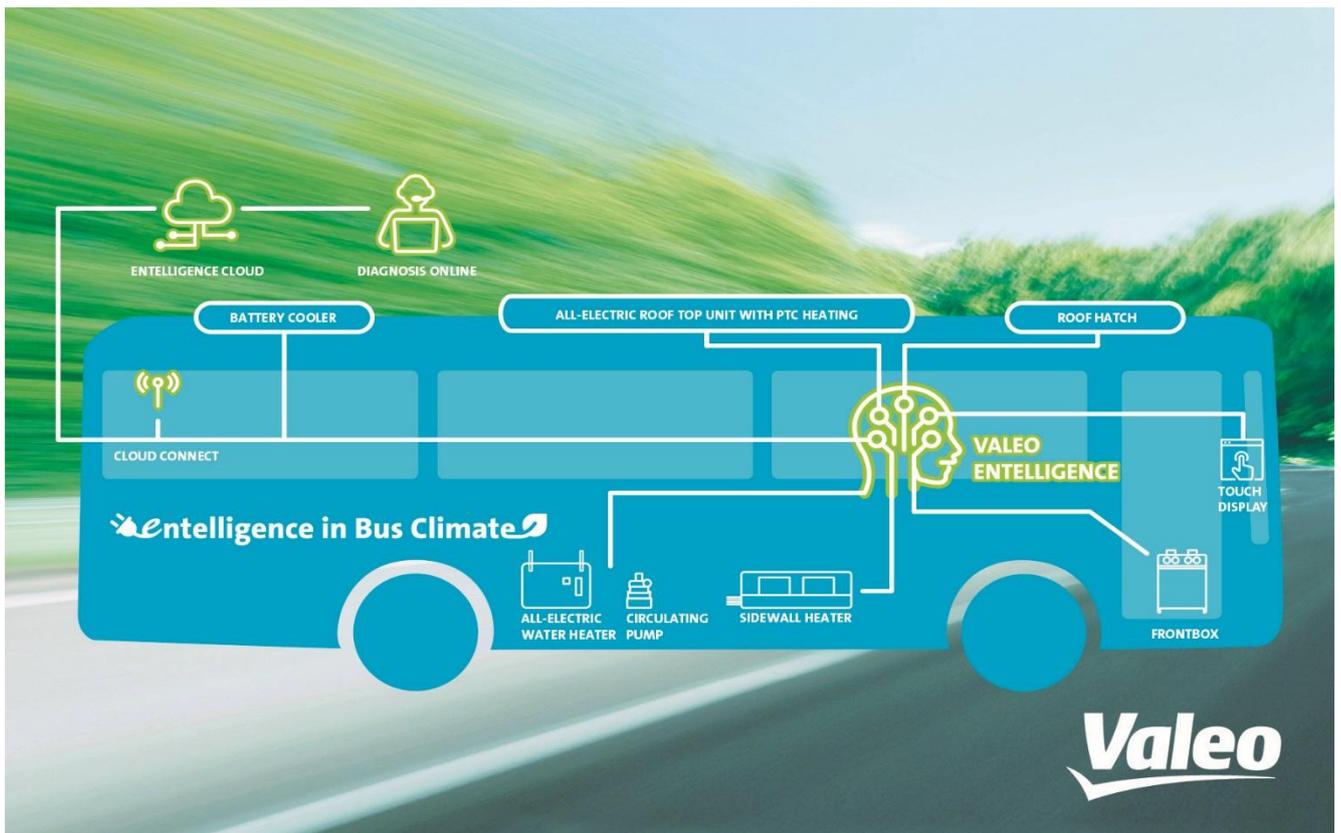
PRESS KIT

VALEO AT THE HEART OF THE BUS AND COACH ELECTRIFICATION REVOLUTION

**VALEO INNOVATIONS ON DISPLAY
AT THE 24TH BUSWORLD EUROPE EXHIBITION
KORTRIJK, BELGIUM – OCTOBER 2017**

CONTENTS

“Entelligence, smart climate control by Valeo	page 3
Bus and coach electrification as innovation drivers for Valeo	page 4
Valeo innovations designed to improve cabin air quality in buses and coaches	page 8
Minibuses can also take advantage of Valeo innovations	page 9
Valeo innovations dedicated to producing heat	page 10
Appendix	page 11



“Entelligence”, smart climate control by Valeo

From October 20 to 25, 2017, Valeo is participating in the 24th **Busworld Europe** exhibition, to be held in Kortrijk, Belgium. The Group is taking advantage of the event to present its latest technological innovations for buses and coaches from around the world. The spotlight is on the full range of Valeo technologies that keep the cabin interior at an optimal temperature at any latitude, regardless of the weather, the size of the vehicle, its powertrain type, and the nature and duration of its journey (whether urban, peri-urban or long-haul).

As the world leader in CO₂ emissions reduction, Valeo is proposing and showcasing a lineup of innovative heating, ventilation and air conditioning (HVAC) solutions specifically designed for electric and hybrid buses and coaches. The stakes in this market are high, as demand for these more environmentally friendly vehicles is set to increase in all markets worldwide. Their rising popularity raises the critical question of how much energy should be used to produce heat or cool air in the cabin.

Valeo is mobilizing every applicable technology to solve that question in a holistic manner. The answer lies in the ability to generate the right air flows, optimize use of available energy in the vehicle, deploy every possible energy harvesting solution, anticipate energy needs and also optimally activate certain components according to the level of energy intensity required. These actions are driven by power electronics and advanced software programs, also developed by Valeo.

The other secret to reducing energy consumption is building lightweight, robust modules and more effectively managing heat exchange in both conventional and electric powertrains. For this reason, Valeo has developed battery cooling systems that are equally effective in extending vehicle range and better protecting battery service life. These innovations, combined with vehicle electrification solutions, work together to improve passenger comfort and decrease the total cost of operating buses and coaches.

Smart climate control combined with bus and coach electrification are signature Valeo solutions. "E" for electrification and "intelligence" come together to form the Entelligence concept. The ability to provide even better air quality in the passenger compartment as well as in the driver cabin is another form of intelligence offered by a number of Valeo-developed systems that will also be unveiled at the 24th Busworld Europe.

Taking things a step further with technologies already suited to the vehicles of the future – that is the Valeo proposition.

At Busworld Europe, Valeo Thermal Commercial Vehicles (formerly Spheros) is appearing for the first time under the Valeo banner and is proud to unveil its new corporate identity.



Valeo is a major player in the automotive industry and ranks among the world's top automotive suppliers. As a technology company, Valeo is fully focused on the design, production and sale of components, integrated systems and modules for the automotive, transportation and freight industries in both the original equipment and replacement segments.

Building on its status as a pioneer, and the world No. 1 in vehicle electric systems (one in every three cars worldwide is already equipped with a Valeo alternator or starter-alternator), Valeo is presenting a very comprehensive offering to support the CO₂ emissions reduction revolution, including in the bus and coach market.

Bus and coach electrification as innovation drivers for Valeo

Fleet managers and companies that build vehicles to transport people are looking for high-performance HVAC (Heating, Ventilation and Air Conditioning) systems that can curb fuel (or other energy) consumption and contribute to reducing CO₂ emissions. Most importantly, the goal is to ensure passengers are comfortable. On this basis, Valeo has developed HVAC modules that stand out for their high degree of energy efficiency, outstanding performance, long lifespan and ability to deliver superior comfort.

Valeo has a comprehensive range of solutions for all bus and coach models – whether electric or hybrid – across all geographies and climates.

Valeo has claimed a strategic leadership position in the electric bus HVAC technology market. Electrification will be a defining trend of the future worldwide, and a big one, particularly in light of the rapid growth and broad diversity of the Chinese market. The requirements demanded of HVAC systems, which are already more complex and differentiated than ever, are creating many new challenges for equipment manufacturers.

DID YOU KNOW?

In urban driving conditions in winter, a vehicle operating in all-electric mode uses practically as much energy to heat the cabin as it does to drive.

In this situation, the thermal management challenge is to ensure passengers enjoy the level of comfort they expect while using as little energy as possible. For this reason, Valeo develops various heat pump architectures that deliver optimal cabin heating and superior air conditioning performance, with a minimal impact on electric vehicle range.

REVO-E Global: a comprehensive solution for electric buses that optimizes HVAC performance in the cabin while minimizing the impact on vehicle range

The REVO-E Global family of electric roof units plays a leading role in electric- and hybrid-bus HVAC systems. Their modular design makes them adaptable to the full spectrum of customer needs, especially in Asian markets. Special emphasis has been placed on keeping the weight of the structure light, extending the output range and simplifying installation.

REVO-E Global has already proved its worth in many countries around the world. The system comes with a heat-pump option (see below) and/or heating components, making it possible to boost the vehicle's range while effectively and efficiently maintaining the cabin temperature at a comfortable level, even in very cold weather.

Thanks to the fully automatic defrosting feature, the heat pump works even when the outside temperature falls precipitously.

The REVO-E Global electric roof unit is affordable to run. With its hermetically sealed refrigeration circuit, REVO-E Global requires virtually zero maintenance and is leak proof. Its low overall weight, energy efficiency and constantly regulated heating function ensure that the vehicle's range is maximized.



Heating with a boost



The systems can be equipped with a new high-voltage positive temperature coefficient (PTC) booster. The booster is triggered when the outflow temperature (in heat-pump mode) needs to rise, when the defrosting feature is activated or simply when more heating power is required. The PTC system leverages the electronic control unit developed by Valeo to deliver an output of up to 20kW.

The robust, easy-to-use SC620 control unit

REVO-E Global is operated by a dedicated control unit made of a waterproof material that can stand up to splashes. The unit is equipped with an onboard diagnostic system and controls the settings for the fans and blowers. It comes in both 12V and 24V models.



Valeo's unique heat pump solution for the bus market extends operating range to -5°C

Taking inspiration from the construction industry, Valeo has extended the REVO-E product family to include a reversible heat pump, which heats, cools and demists electric vehicle cabins. This model offers the considerable advantage of ensuring the heat pump keeps running at outside temperatures of between 5°C and 15°C. In addition, due to a fully automatic and highly efficient de-icing function, the Valeo heat pump can also be operated at temperatures as low as -5° C, which is what makes the Valeo system unique. A CO₂ version that Valeo engineers are currently working on further extends the range of the heat pump function to -20°C.

The heat-pump version will be available also for the REVO-E Global in the near future. The water-based heat exchanger and PTC heater are available as options for the REVO family.

High-voltage modular heating solution

Valeo's engineers are working on an innovative high-voltage heating system for electric buses that saves space because of its modular design. Its compact size means that it can fit into even the tightest spots. Several units can be connected to the system according to user needs.

With the Thermo AC/DC and Thermo H hybrid heaters, this robust 12kW solution has rounded out the electric heater range to meet every type of need in the global electric bus market.

Valeo SPump offers advanced performance for e-bus applications worldwide

Valeo's well-known SPump range has been expanded. Now comprising four different versions offering 260W and 500W capacity, with a PWM and CAN variable speed control feature in order to save energy, the series has been developed for vehicles with a hybrid, plug-in or electric drive and offers major advantages for meeting the toughest demands.

With its extended ambient temperature range of up to 95°C at the highest level of reliability, the SPump is the best solution for water pumps worldwide.

The Valeo SPump is now even shorter and quieter – at 2.3 kg, it is the lightest unit in its class.



Valeo's market-leading battery cooler



To operate, electric vehicles need batteries, which are costly and highly sensitive to changes in temperature, particularly when charging. For optimal longevity and performance, the batteries' temperature must be maintained at between 15°C and 45°C and consistent across the cells. An increase of just 10°C above the limit determined for the battery halves its service life.

Valeo's technologies protect batteries from the risk of degradation. Leveraging its extensive experience in the area, Valeo offers automakers a wide variety of solutions for

both hybrid and all-electric vehicles, as well as designing and manufacturing compact systems to meet all of their needs across the price spectrum.

The Valeo-developed battery cooling system maintains the battery cells in hybrid and electric vehicles at an ideal operating temperature – below 45°C – while ensuring a consistent temperature across the cells. The batteries are cooled by either refrigerant or glycol circulating through a chiller inserted optimally into the battery pack.

Valeo can design battery cooling systems of all sizes to adapt to any vehicle type, whether hybrid, plug-in hybrid or all-electric. Thanks to the solution's ultra-flat design, the plates and tubes make excellent contact with the battery pack, thereby ensuring a uniform temperature. Valeo is the leader on this market, with a projected market share of 15% in 2018.

Valeo battery cooler for E-bus applications:



Valeo innovations designed to improve cabin air quality in buses and coaches

In a world first, Valeo is unveiling at Busworld Europe 2017 a range of solutions to improve cabin air quality in buses and coaches.

A good illustration is its **multi-fragrance diffuser**, a new feature designed to optimize passengers' feeling of well-being. Offering a full palette of fragrances, the diffuser helps to prevent fatigue and reduce stress. In addition, highly efficient **activated carbon filters** protect travelers from air pollution by trapping the finest particulate matter (PM_{2.5}), without undermining the performance of the HVAC system. High-quality carbon ensures optimal filtration of gases such as NOx and neutralizes odors. The filters can also be treated with polyphenol to deactivate allergens suspended in the air.

Depending on the specifications and whether the equipment is required for long-haul travel or for city driving, the HVAC system can be fitted with a highly efficient Valeo cabin air filter. This may be an activated carbon particulate filter including a very high efficiency filter capable of capturing particles smaller than 2.5µm.

Valeo also develops other technical solutions to improve driver well-being and reduce pollution and lingering odors in the cabin.

Minibuses can also take advantage of Valeo innovations

The Valeo Minisphere rooftop air conditioner

The Valeo Minisphere rooftop air conditioner sets a new benchmark in terms of weight, design, performance and efficiency.

The unit can be installed on all minibuses and adapts to all weather conditions.



Offering a cooling capacity of 10kW or 13kW, the modular Valeo Minisphere rooftop air conditioner is compatible with all minibuses. The unit weighs in at a mere 38kg for the 10kW version – 22kg less than the previous model – making it the lightest minivan air conditioning solution on the market. Its aluminum construction is what gives it this unique quality. Due to its light weight, the unit is fast and easy to install on the vehicle. Its sleek, aerodynamic design blends in optimally with the vehicle's overall silhouette. In addition, the unit has optional heating and fresh air functions (30% fresh air).

The SC 400 control unit coupled with the Minisphere

The Minisphere air conditioner is operated by a dedicated control unit. It can work in manual or automatic mode and is robust enough to meet the tough requirements of manufacturers around the world. It features a waterproof exterior, temperature settings to within half of a degree Celsius, three-speed fans and a screen displaying error messages when necessary.

Valeo innovations dedicated to producing heat

The Valeo Thermo plus heating unit, even shorter, quieter and more economical



The newly developed Thermo plus heater is the latest result of almost 40 years of development, production and sales. It is significantly shorter and lighter than its predecessors, and has an extended service life while generating less starting noise and exhaust emissions.

The Thermo plus heater – available in the three performance classes 23kW, 30kW and 35kW – will be launched on the market easily as the interfaces are identical to previous models.

The Valeo Thermo E+ heating unit, for higher performance, lower emissions and more applications

Available in 20kW and 32kW versions, the Valeo Thermo E+ bus heating unit uses minimal energy to produce heat, making it extremely cost effective.

The solution also offers a high degree of reliability thanks to the use of time-tested components and an integral control unit with waterproof connectors. In addition, maintenance is limited to simple operations, further reducing total running costs.

A 12kW-variant representing the lightest solution on the market for minibuses

In addition to the 20kW and 32kW versions, Valeo has developed a 12kW unit measuring just 435mm in length and weighing no more than 13.5kg, representing the lightest **minibus** heating solution available on the market.



Appendix

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