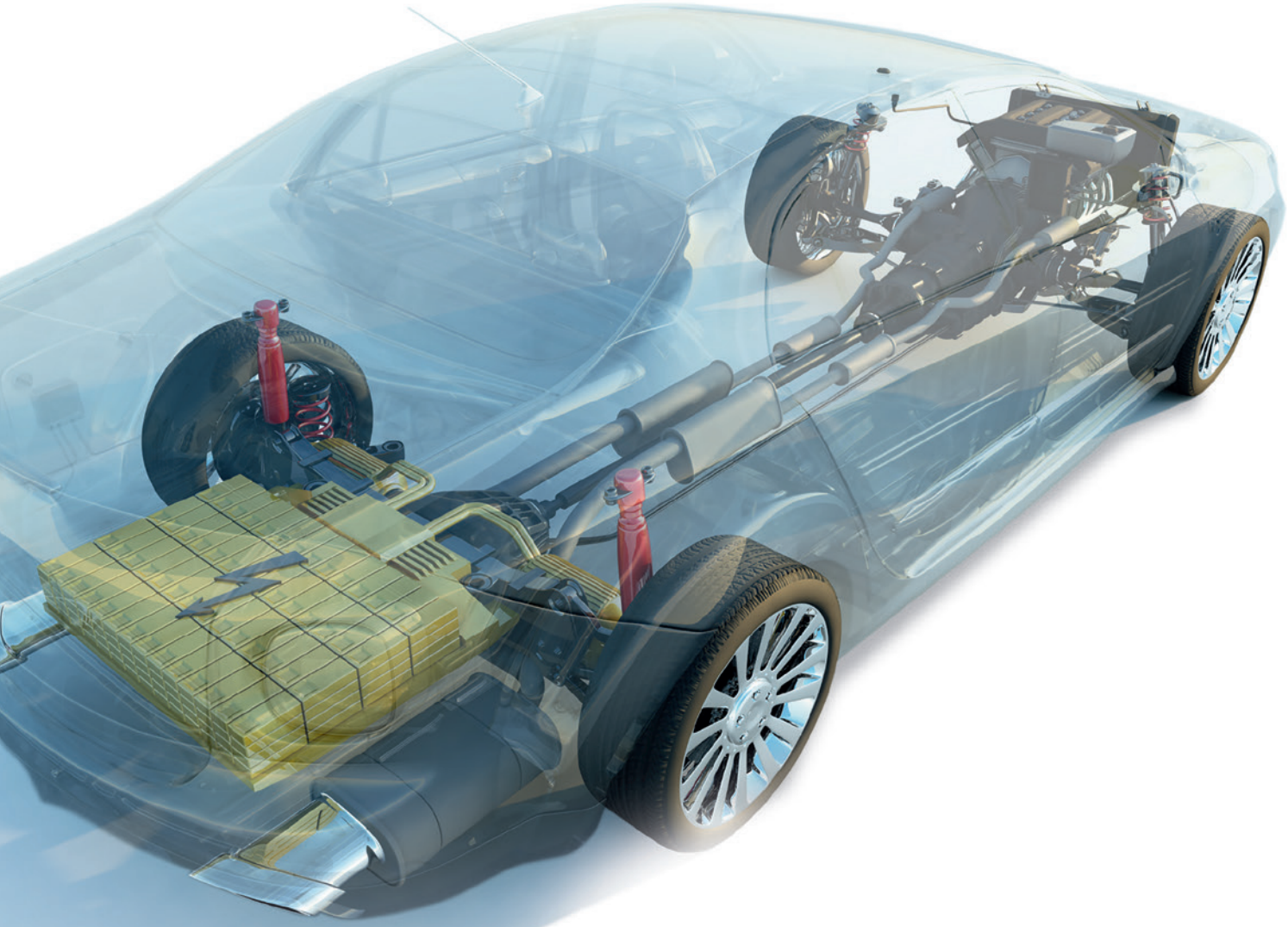
POPPE+POTTHOFF



E-Mobility | Testing Machines

Poppe + Potthoff Maschinenbau GmbH

Poppe + Potthoff Maschinenbau and E-Mobility

Poppe + Potthoff Maschinenbau GmbH develops and manufactures systems for testing the operation and fatigue strength of components in the automotive sector.

To demonstrate the quality of media-carrying vehicle components, the drive units (electric motors), valves, cooling and heating systems, hose lines, tubes, pressure vessels and other components are subjected to pressure. Whether for dynamic pressure change tests, static pressure holding tests, flow measurements or classical bursting pressure tests.

Poppe + Potthoff Maschinenbau offers you an individual solution matched to your requirements. In addition to the pressure and lifecycle tests, the test benches from Poppe + Potthoff Maschinenbau provide the possibility to carry out functional tests with live components. Here, the focus is primarily on efficient energy management as well as the performance under changing temperature conditions.

All tests are measured and documented exactly in order to design the components optimally for specific applications.

Further information: www.e-mobility-test-stand.com

Thermal management on the test stand

TSC-05E – The electric racer

Four electric motors accelerate the vehicle from 0 to 100 km/h in just 2.1 seconds. The key to success is optimum thermal management to ensure that all components function reliably. In the two cooling circuits, the maximum temperature is 40 °C.

Some components were developed completely from scratch, such as the four inverters that convert the direct current of the battery box into alternating current using the latest SiC transistors for the drives with a peak output of 80 kW and regulate their output.

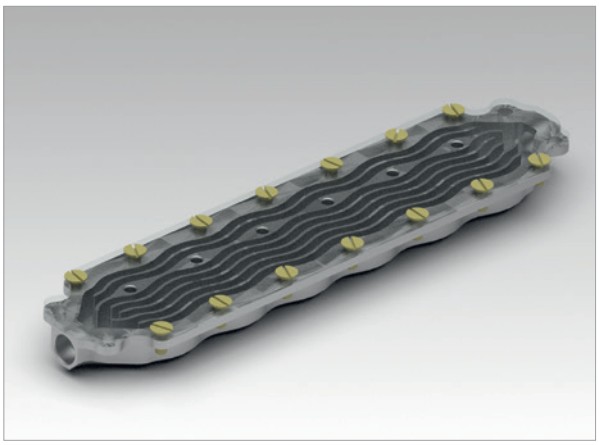
Team Starcraft

At the Technical University of Ilmenau, students develop and build a new electric and autonomous racing car every two semesters in order to take part in international „Formula Student“ competitions.

As one of the main sponsors, Poppe + Potthoff not only provides financial support, but also manufactures and tests components. The technology exchange between the university and the company is particularly important for the optimization of the thermal management.

Technical details:

Power: 80 kW peak power
System voltage: 600 V
v max: 115 km/h
0–100 km/h: 2,1 s
L/B/H: 2790 mm / 1481 mm / 1050 mm
Wheelbase: 1530 mm
Weight: 185 kg
Battery capacity: 8,3 kWh



The cooling jackets of the inverters must be reliably sealed. They work with an operating voltage of 600 V and are placed close to the battery box. The tightness for service life is verified using testing equipment from Poppe + Potthoff Maschinenbau.

Pressure cycling test bench for climate components

For thermal management in the vehicle, cooling and heating systems are essential. They protect against overheating and ensure comfort. Poppe + Potthoff Maschinenbau developed a special system to simplify and speed up life cycle tests. It simulates driving for the test specimen through freely programmable temperature, volumetric flow rate and pressures changes in a sinusoidal and trapezoidal form.

Mobility requires reliable cooling and heating systems. These help man and machine – whether electric or combustion engine – to adapt to varying environmental conditions. In the process, climate systems and all their components must permanently stand up to high load changes. Instead of expensively testing the durability in real operation, manufacturers can now try out their components with the help of the pressure change test bench of Poppe + Potthoff Maschinenbau in an early stage of development, and can do so flexibly and economically in fast motion.

Testing at -40 to +140 degrees Celsius

The component, for instance auxiliary heating for an electric car, is put in the test chamber. A water-glycol mix or pure glycol (e.g. Glysantin G40, G44, G48) serves as a test medium. In the cooling cycle, tests are carried out in a temperature range from -40 to +20 degrees Celsius, in the heating circuit from +20 to +140 degrees Celsius. A specially developed closed test equipment circuit uses pressure to prevent the formation of alcoholic vapours (risk of explosion). Optionally, the environmental simulation can also be generated by an additional climatic chamber.

The volumetric flow rate can vary from 3 to 20 l/m with a pressure of 0.2 to 10 bar (max. 12 bar). The load changes are freely programmable with a sinusoidal or trapezoidal rise in a test frequency of 0.2 to 1 Hz. With the test system, it is possible to test complete systems as well as individual assemblies made of plastics, metals and sealants. With the help of the realistic simulation, the weaknesses in the material compound are sounded out precisely, for example in the area of a weld seam, and can be optimised early in the development process.

Optimisation of climate components and systems

The measurement data recording and visualisation are handled like with all PPM systems, with LabVIEW applications from National Instruments. The open software structure makes it possible to integrate additional sensors and measurement data in the test. That way, numerous, customer-specific, relevant parameters can be mapped. All test sequences and data are saved automatically in the system and can be exported in the network for analysis. The system can be adapted in a customer-oriented way and remote maintenance and on-site service complete the service package.

Performance data:

Medium: Water-glycol mix / pure glycol

Media temperature control: Cooling circuit: +20°C to -40°C
- Cooling capacity up to -30 °C 5 kW
- Cooling capacity up to -40 °C 2 kW

Media temperature control heating circuit: +20°C to +140°C
- Heating capacity: 12 kW

Volumetric flow rate control 3 to 30 l/min

Ambient temperatures: -40°C to +140°C
(possible with the respective climatic chamber)

Dynamic pressure change: 0.2 - 10 bar

Frequency: 0.2 Hz

Ramp shape: trapezoidal & sinusoidal

Static pressure drop test: up to 12 bar

Any pressure curve up to 12 bar is programmable with PPM FdrV

Function test bench

Heating and cooling come at the cost of range on the way to electromobility, because the current required must be branched off from the battery power. To increase energy efficiency, it is necessary to test climate-control units under realistic conditions. The function test bench from Poppe + Potthoff Maschinenbau (PPM) makes it possible to carry out complex long-term testing with changing temperatures, quickly and locally. In the process, a power supply is simulated with low or alternatively high voltage via the vehicle or traction battery.

Development cycles are becoming shorter and shorter, especially in the automotive industry, which is increasingly orientated around the manufacture of electric vehicles. To quickly adjust to the new requirements, component suppliers need not only good ideas for products, but also systems that enable quick validation. Test benches from Poppe + Potthoff Maschinenbau are designed to test prototypes or serial parts realistically, quickly and economically in order to recognise and resolve weaknesses. With the function test bench, the current consumption and heating and cooling capacity of air-conditioning units are put on the test bench with varying temperatures.

Performance test with changeable temperatures

The unit is put in the test chamber, and connected to the test media circuit. For simulation of the battery operation in the electric vehicle, a power supply is available with low voltage (0 to 20 VDC/5A) or high voltage (0 to 600 VDC/150A). The test medium (water-glycol mix or pure glycol, e.g. Glysantin G40, G44, G48) is circulated with a freely controllable temperature of -34 to +100 degrees Celsius and a volumetric flow rate of 3 to 30 l/min. Optionally, the test can also be carried out in the climatic test chamber at -40 to +140 degrees Celsius in order to simulate changing ambient temperatures.

A meaningful long-term test usually takes 20 days. In the process, the temperature and volumetric flow rate of the test medium vary around the clock in accordance with the programmed test cycles, as well as the ambient temperature if the test is carried out in the climatic test chamber. The temperature of the test medium is measured continuously at the inlet and outlet of the test specimen, as well as the ambient temperature. The flow, pressure and pressure drop as well as current and voltage in the high- and low-voltage range are also documented. The focus is on the thermal and electric performance of the heating or alternatively cooling unit with varying environmental conditions.

Safe and easy to operate

The system meets the highest safety standards and is very easy to operate. The measurement data recording and visualisation are handled like with all PPM systems, with LabVIEW applications from National Instruments. All test sequences and data are saved automatically in the system and can be exported in the network for analysis. The open software structure makes it possible to integrate additional sensors and measurement data in the test. That way, numerous, customer-specific, relevant parameters can be mapped. Fast service via remote maintenance and technicians onsite are also part of the service package.

Performance data:
Medium: Water-glycol mix or pure glycol
Media temperature: -35°C to +100°C - Cooling capacity: 15 kW at -35 °C - Heating capacity, electric: 25 kW
Ambient temperature control: -40 °C to +140 °C (optional)
Volumetric flow rate control 3 to 30 l/min
Battery simulation: - High voltage: 0 to 600VDC / 150A - Low voltage: 0 to 20VDC / 5A

Measurement data:
Temperature medium at test specimen inlet and outlet
Ambient temperature
Flow
Pressure
Pressure drop
Electrical performance
Thermal performance
HV and LV voltage
HV and LV current
HV maximum value current

Universal test bench for thermal management

The requirements of OEMs are manifold. But with the universal test bench from Poppe + Potthoff Maschinenbau numerous test standards can be fulfilled. Whether drive units, battery housings, cooling circuits or heating systems (HV), DC-DC converters, inverters, coolers, pumps, lines or valves: Pressure cycling tests can be carried out in the climatic chamber at varying ambient and media temperatures. Tightness, bursting pressure and vacuum tests as well as functional tests are also possible.

The test chamber – here 1,500 x 1,000 x 1,000 mm (W x H x D) – is explosion-proof in accordance with the ATEX directive. The ambient temperature can vary from -40°C to +150°C, and the temperature of the test medium from -40°C to +140°C. Extreme conditions can thus be simulated in order to test the complex thermal management in the vehicle safely and efficiently at the same time.

Extreme load changes

The flow rate can be controlled from 0.5 l/min to 30 l/min. The test pressure can be static up to 20 bar or change dynamically - from 0.2 to 6 bar in sinusoidal and trapezoidal curves at a frequency of up to 2 Hz (on request also beyond that).

A vacuum test between atmosphere and 18 mbar, a pressure loss test up to 1,000 mbar and leakage rate tests up to 0.5 cm3/min are also possible with the universal test stand.

High flexibility at maximum security

The test benches from Poppe + Potthoff Maschinenbau are very easy to operate and meet the highest safety standards. The test chamber is made of welded stainless steel, the safety window of high-strength polycarbonate. The test sequences created can be called up manually via coded recipe management or simply via hand scanner. Measurement data acquisition and visualization are carried out with LabVIEW applications from National Instruments.

All test sequences and data are automatically stored on the system and can be exported to the network for evaluation. An open software structure allows additional sensors (e.g. thermal sensors) and data to be included during testing. This allows the system to be expanded at any time, to map numerous customer-specific relevant parameters.

Performance data:

Media temperature control: -40°C to +140°C	Frequency: up to 2 Hz (other frequencies on request)
Test chamber: with Ex-protection for pressure tests with coolant (ATEX)	Pressure loss test: up to 1,000 mbar
Test chamber size: 1,500 x 1,000 x 1,000 mm (W x H x D)	Static pressure test: up to 20 bar with compressed air and adjustable pressure rise
Ambient temperature control: -40°C to +150°C with up to 3.5 K/min	Leak rate test: 0,5 cm^3/min
Volumenstrom: 0,5 l/min bis 30 l/min regelbar	Vacuum test: pressure change between atmosphere and 18 mbar abs
Test pressure: dynamic 0.2 to 6 bar with sinusoidal and trapezoidal curves	

Pressure cycling test benches for automotive components

For impulse testing with subsequent long-term pressure and burst testing, our systems provide two chambers in which up to ten test specimens each can be tested simultaneously at an ambient temperature of -60 °C up to +180 °C or an indoor climate. Via separate control circuits, the medium (100% glycol or different oils) is added with a temperature from room temperature up to +160 °C. That way, tests are possible with very large temperature differences that are realistic even during endurance tests on the race track at the Nürburgring, in the Siberian tundra or in the deserts of Africa.

Different servo-hydraulic pressure transducers, which are optimally designed for each test range, enable very precise regulation of the pressure. In the process, impulse pressure tests can be performed with a frequency of 0 – 10 Hz (0.5 – 2.5 Hz is usual) with a trapezoidal curve with 4 – 25 bar and 0 – 160 bar. With the sinusoidal curve with a frequency of 0 – 10 Hz, pressures of 0 – 6 bar are possible. The maximum burst pressure is 500 bar. The measurement data recording and visualisation are handled with LabVIEW applications from National Instruments. All test sequences and data are saved automatically in the system and can be exported in the network for analysis.

Performance data:

3 different load change tests	Frequency: 0.5 to 2.5 Hz (max. 10 Hz)
3 different media (each with a double tank system)	Media temperature control: RT up to +160°C
Additional burst pressure testing: up to 500 bar	Ambient temperature control: -60°C to +180°C
Additional leak testing: up to 100 bar (long-term test)	

Burst pressure test benches for plastic components

The burst pressure test bench is an independently working system. It was developed especially for the plastics industry. The test specimens can be easily adapted via quick couplings. Furthermore, a quick-change device is possible to be able to mount the test specimen by hand outside the test chamber.

Two test circuits are available for burst testing with different modes of operation. A very precise pressure increase up to 50 bar is possible via the wear-free fine control method. A pneumatically driven pressure transducer works in the other test circuit, with which pressure of up to 400 bar can be generated. Normal tap water or test oil can be used as a test medium.

In addition, the test bench can be equipped with a handheld scanner for identification of the components in order to assign the burst pressures to each component. The system is controlled by a PLC with a serial interface for the data exchange. A touch panel is used to enter the test requirements.

Performance data:

Burst pressure up to 400 bar
0 - 50 bar fine pressure control
Tests with different media and temperature control

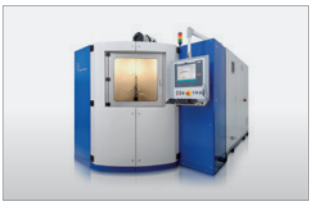
Poppe + Potthoff Maschinenbau

Poppe + Potthoff Maschinenbau GmbH develops and produces test benches and special machines for research, development and production in the automotive, commercial vehicle and shipbuilding industries as well as in other industries. These include test benches for measuring burst pressure, leak tightness and fatigue strength, for impulse testing up to 6,000 bar, for autofrettage and for functional testing of media-carrying components and systems in vehicles with electric, hydrogen, LPG, petrol or diesel engines. The company, based in Nordhausen (Germany), is a member of the Poppe + Potthoff Group and serves the automotive and heavy-duty industries worldwide.

Our special machines:

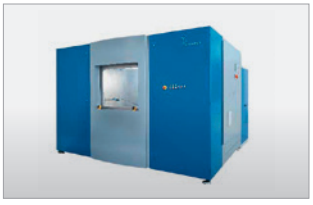

Autofrettage systems


Leak testing test benches


Impulse test benches


Test and measurement systems


Burst pressure test benches


Function test benches


Hydraulic units

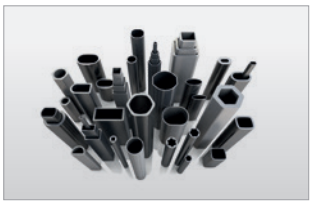

Compressed air boosters

Poppe + Potthoff Group

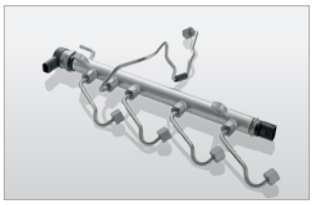
Poppe + Potthoff stands for precision. The corporate group develops and produces customer-specific steel tubes, common rail subsystems, high-pressure lines, precision components, universal shafts and couplings as well as custom machinery and test benches. Poppe + Potthoff thus enables technically sophisticated solutions in the automotive and the commercial vehicle sector, the shipbuilding industry, in toolmaking and mechanical engineering as well as other Industries. Founded in 1928, the family-owned company with headquarters and technology center in Werther (Germany) employs around 1700 people. With subsidiaries and longstanding partners, Poppe + Potthoff is active in over 50 countries close to its customers.

Product segments of the Poppe + Potthoff Group:

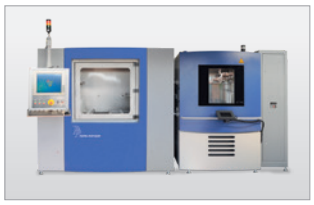
Tubular Components



Precision steel tubes



Common rail components

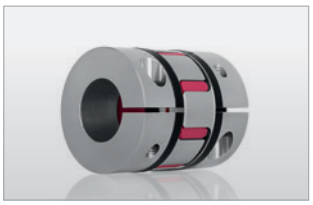


Special purpose machines

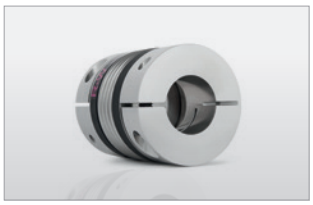
Precision Components

Components for brake and injection systems, transmissions, steering, hydraulics, safety systems and other applications

Drive Technology



Elastomer couplings



Precision couplings

Industrial couplings

POPPE+POTTHOFF

Poppe + Potthoff
Maschinenbau GmbH
An der Helme 26
99734 Nordhausen
Phone +49.(0)36 31.46 22 10-0
Fax +49.(0)36 31.46 35 32
salesppm@poppe-potthoff.com
www.poppe-potthoff.com