

Quality inspection: In a vehicle, media-carrying components must withstand extreme strains at temperatures ranging from  $-40^{\circ}\text{C}$  to  $+140^{\circ}\text{C}$ . Poppe + Potthoff Maschinenbau develops testing systems to check and optimize them efficiently.

## Pressure test stands for hydrogen ( $\text{H}_2$ ) components by Poppe + Potthoff

# Hydrogen (H<sub>2</sub>) component test systems for research & development

Poppe + Potthoff Maschinenbau GmbH develops test systems for research & development and validation of media carrying hydrogen components

## KEYWORDS

Pressure cycle test bench | Burst test bench | Hydrostatic fatigue testing | Testing with coolant, oil, water and more

At Poppe + Potthoff Maschinenbau we offer test stands in the field of pressure pulsation testing, pressure cycle testing, burst pressure testing and hydrostatic (fatigue) testing. The test benches are used in various component testing set-ups. Some examples are: shut-off valves, connection parts for containers, flexible fuel lines, non-return valves, pressure regulators, pressure reducers, pressure relief valves, flow sensors and sensors for detecting hydrogen leaks.

Author: Johannes Montag



Burst test stand

## Hydrostatic pressure fatigue- and burst test

In a typical test, the component is inserted into the test chamber of the burst test bench. This can be an auxiliary heater for an hydrogen car or valves, hoses and other hollow bodies that need to withstand

more than 100,000 load changes over the lifetime of the vehicle (up to 15 years). The test benches of Poppe + Potthoff Maschinenbau allow for testing of the hydrostatic strength of components with pressures up to 3,000 bar or more.

### Highlights:

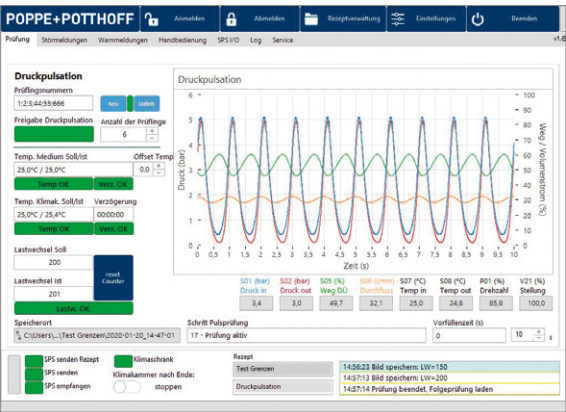
- Linear pressure increases up to 3,000 bar or more
- Displacement volume max. 235 cm<sup>3</sup>
- Variable programmable pressure ramps possible
- Pressure hold times possible
- Suitable for hydrostatic and burst pressure tests
- Including function for increased displacement

Traction battery: It not only drives the engine, but also supplies the vehicle's entire electrical system with power. In Poppe + Potthoff Maschinenbau's function test stand, the energy efficiency of heating and cooling units can be tested and optimised to increase the accumulator's performance.

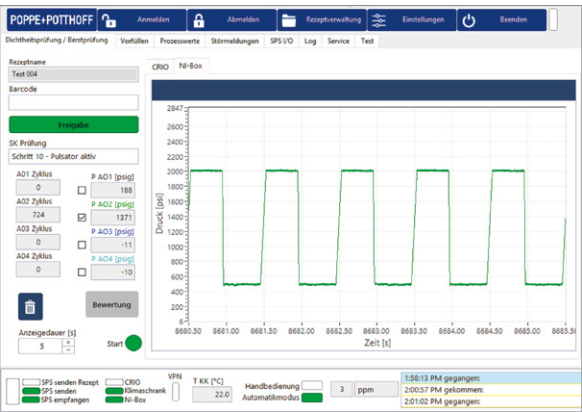




The flow rate of the test medium can vary from 1 – 50 l/min at a pressure of 0.2 – 12 bar or higher. The load changes are freely programmable with sinusoidal or trapezoidal rise at a test frequency of 0.2 – 2 Hz or faster. The test stand can be used for complete systems, assemblies and components made of various plastics, metals and sealants.



Weak points in the material combination – for example around a weld seam – can be sounded out and optimized early in the development process as well as during production.



The pressure cycling test bench from Poppe + Potthoff Maschinenbau tests climate-control components at -40 to +140 degrees Celsius. Temperature, volume flow and pressure changes can be freely programmed in sinusoidal and trapezoidal form at a test frequency of e.g. 0.2 to 2 Hz and enable fast and economical testing.

Leak test stand <1050 bar with gas (helium)

Fields of application:

Hydrogen (H<sub>2</sub>) components



Technical specifications:

- Leak test with helium, nitrogen, N<sub>2</sub>/H<sub>2</sub>, forming gas
- Tests with up to 1,050 bar
- Testing in a climate chamber possible
- Tests in a water bath
- Bersting pressure test with water <3,000 bar for pre-validation
- Safety concept with massive box in th climate chamber

Time lapse for long-term tests Safe and easy to use

A long-term test usually takes 20-30 days, depending on the frequency of the load changes. The temperature and volume flow of the test medium as well as the ambient temperature (if the test takes place in the climatic chamber) vary according to the test specification.

Poppe + Potthoff Maschinenbau test systems are easy to operate and extremely safe. The test chamber consists of welded stainless steel and a high-strength polycarbonate safety window. Any test sequences created on the PC can simply be called up manually via coded recipe management or by a handheld scanner.

Highlights:

- Displacement volume max. 600 cm
- Frequency up to 10 Hz
- Pressure curve programable as sine & square (trapezoidal) curve
- Including extension of the hydraulic unit to 75 kW
- Pressure testing up to 1,200 bar



Pressure cycle test bench up to 700 bar for H<sub>2</sub> systems. Two-stage flexible pressure cycle intensifier for large volumes up to 1,200 bar

Temperature ambient:	-40°C to +160°C with rate of change 1,5 K/min
Temperature fluid:	-40°C to +135°C
Test chamber:	with Ex protection for pressure test with coolant (ATEX)
Size of test chamber:	1,500 x 900 x 900 mm (W x H x D)
Flow rate coolant:	0,5 l/min up to 30 l/min adjustable
Test pressure:	dynamic up to 1,200 bar with sinus- and trapezoidal curve
Frequenzy:	up to 2 Hz (further frequencies upon request)
Pressure drop test:	up to 1,000 mbar
Static pressure test:	up to 20 bar with compressed air and adjustable pressure increase
Leak rate test:	0,5 cm <sup>3</sup> /min
Vacuum testing:	Pressure variation between atmosphere and 18 mbar abs.

# R & D Pressure pulsation & burst test stand for H<sub>2</sub> components up to 2,000 bar

The system is a self-sufficient unit and is made of a solid welded frame, contains media preparation, a hydraulic unit and electrical engineering. The pressure test bench has a secure test chamber for burst pressure and hydrostatic pressure tests and, optionally, a climatic chamber for pressure tests with environmental simulation.

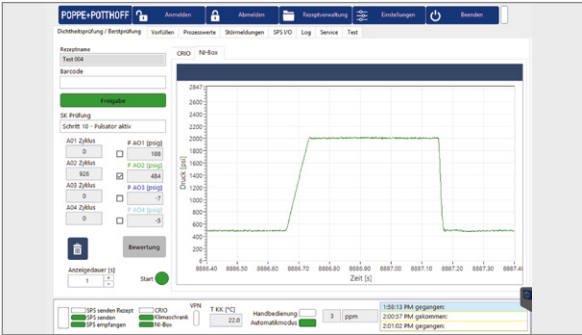
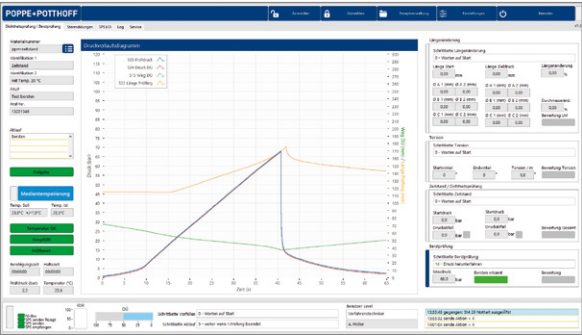
Depending on the option selected, pressure change tests up to 2,000 bar and 10 Hz can be generated. With the test circuit for hydrostatic and burst pressure tests, pressure ramps up to 3,000 bar can be generated. It is operated on a support arm PC.

## For pressure tests according to EG79 / EU406 - Section 4.2

- Impulse intensifier for small volumes up to 2,000 bar
  - Displacement volume max. 15 cm<sup>3</sup>
  - Frequency up to 10 Hz
  - Pressure load changes as sine & trapezoidal curve (depending on the expansion volume)
- Safety test chamber with automatic door
- Media treatment with dirt and clean tank
- Refill for pressure change test complete electrotechnical equipment for pressure tests
- Controller for maximum precision



Pressure pulsation & burst test stand:  
1x chamber + 1x climate chamber



# Performance data

Exemplary systems from Poppe + Potthoff Maschinenbau

## Pressure cycling test stand

### Testing media:

- Water-glycol mixture
- Pure glycol
- Oil, test fluid or other liquids

### Media temperature control:

- Cooling circuit: 5 kW to -30°C, 2 kW to -40°C
- Heating circuit: 12 kW +20°C to +140°C

### Volume flow control:

- 1 to 50 l/min

### Ambient temperature control:

- -40°C to +140°C (optional with appropriate climatic chamber)

### Dynamic pressure cycling:

- 0,2 to 1,200 bar or higher
- Frequency: 0,2 Hz-2 Hz or higher

### Ramp form:

- Trapezoidal & sinusoidal, static pressure 1,200 bar

### Measured data:

- Temperature of medium
- Ambient temperature
- Flow rate
- Pressure
- Pressure drop

## Function test bench

### Testing media:

- Water-glycol mixture
- Pure glycol
- Oil, test fluid or other liquids

### Media temperature control:

- Cooling circuit: 15 kW to -35°C
- Heating circuit: 25 kW to +100°C

### Volume flow control:

- 1 to 50 l/min

### Ambient temperature control:

- -40°C to +140°C (optional with appropriate climatic chamber)

### Battery simulation:

- High Voltage: 0 to 1000V<sub>DC</sub> / 150A
- Low Voltage: 0 to 20V<sub>DC</sub> / 5A

### Measured data:

- Temperature of medium at the inlet and outlet of the test specimen
- Ambient temperature
- Flow rate
- Pressure
- Pressure drop
- Electrical output
- Thermal performance
- Voltage HV and LV
- Current HV und LV
- Maximum value current HV

**Poppe + Potthoff Maschinenbau GmbH** designs and manufactures test stands for measuring the strength and durability of components in automotive engineering and shipbuilding as well as other industries. The precise and high-performant special machines by the expert for high-pressure and test technology are used in research, development and production. This includes test stands for measuring bursting pressure and tightness, impulse testing, autofrettage as well as automated testing. In addition, comprehensive component tests are offered as a service. The company based in Nordhausen (Germany) is a member of the Poppe + Potthoff Group.



**Poppe + Potthoff** stands for precision and technology. We supply the commercial vehicle and automotive industries, among others, with specially developed common rail subsystems, high-pressure lines, precision and industrial couplings and other components for sophisticated hydrogen systems and E-mobility applications. Our group functions as a network, allowing us to combine our remarkable people and production facilities, to come up with the best possible solution for our customers' needs. Our in-house capabilities range from engineering and validation, through production and finishing to quality assurance and packaging. Founded in 1928 in Werther, Germany, we have grown into an international group with over 1,500 employees at 18 locations.

## THE PRECISION-MAKERS



**Stefan Dreyer, CEO | Johannes Montag, CEO / Head of Sales | Frank Baudler, CTO**

### Contact sales:

Poppe + Potthoff Maschinenbau GmbH  
An der Helme 26  
99734 Nordhausen | Germany

Phone: +49 (0)3631 462210-22  
E-mail: [salesppm@poppe-potthoff.com](mailto:salesppm@poppe-potthoff.com)

[www.wasserstoff-prueftechnik.de](http://www.wasserstoff-prueftechnik.de)

**[www.poppe-potthoff.com](http://www.poppe-potthoff.com)**