Pressure test stands for hydrogen (H₂) components by Poppe + Potthoff
Hydrogen (H₂) 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.

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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. 235cm³
- 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 economic testing.

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.

Highlights:
- Displacement volume max. 600 cm³
- 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

Time lapse for long-term tests

Safe and easy to use

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.

The integrated LabView software from National Instruments enables efficient data acquisition and visualization. Test procedures and data are automatically stored on the system and can be exported to the network for evaluation. The open software structure makes it possible to integrate additional sensors and data during testing. Poppe + Potthoff Group can provide numerous testing services, remote maintenance and on-site technicians, if necessary.

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
Frequency: 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 cm³/min
Vacuum testing: Pressure variation between atmosphere and 18 mbar abs.
**Performance data**

Exemplary systems from Poppe + Potthoff Maschinenbau

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**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 to +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

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**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 1000VDC / 150A
  - Low Voltage: 0 to 20VDC / 5A

- **Measured data:**
  - Temperature of medium
  - Ambient temperature
  - Flow rate
  - Pressure
  - Pressure drop
  - Electrical output
  - Thermal performance
  - Voltage HV and LV
  - Current HV and 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.

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